# WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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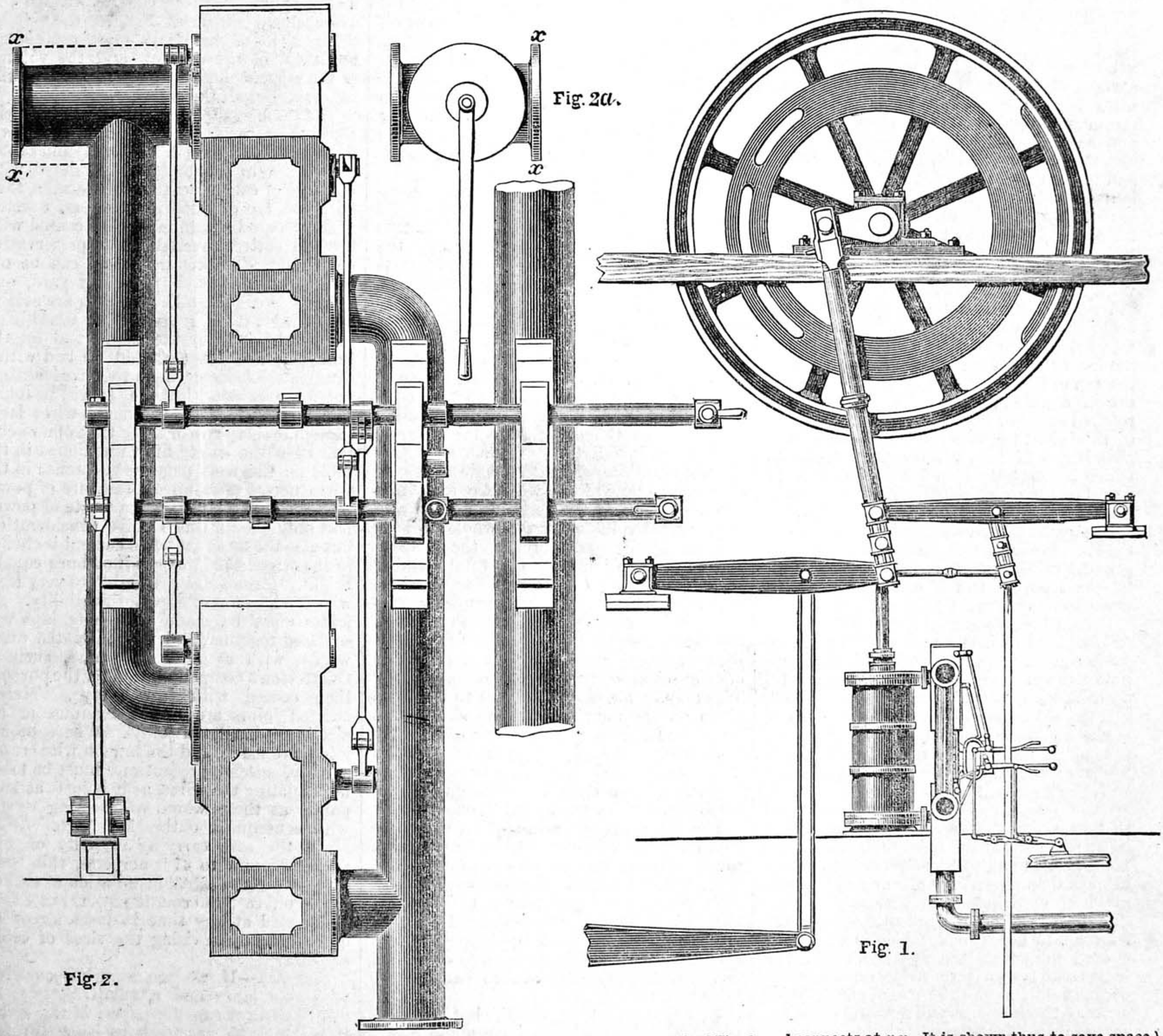



Fig. 2.



Fig. 1.

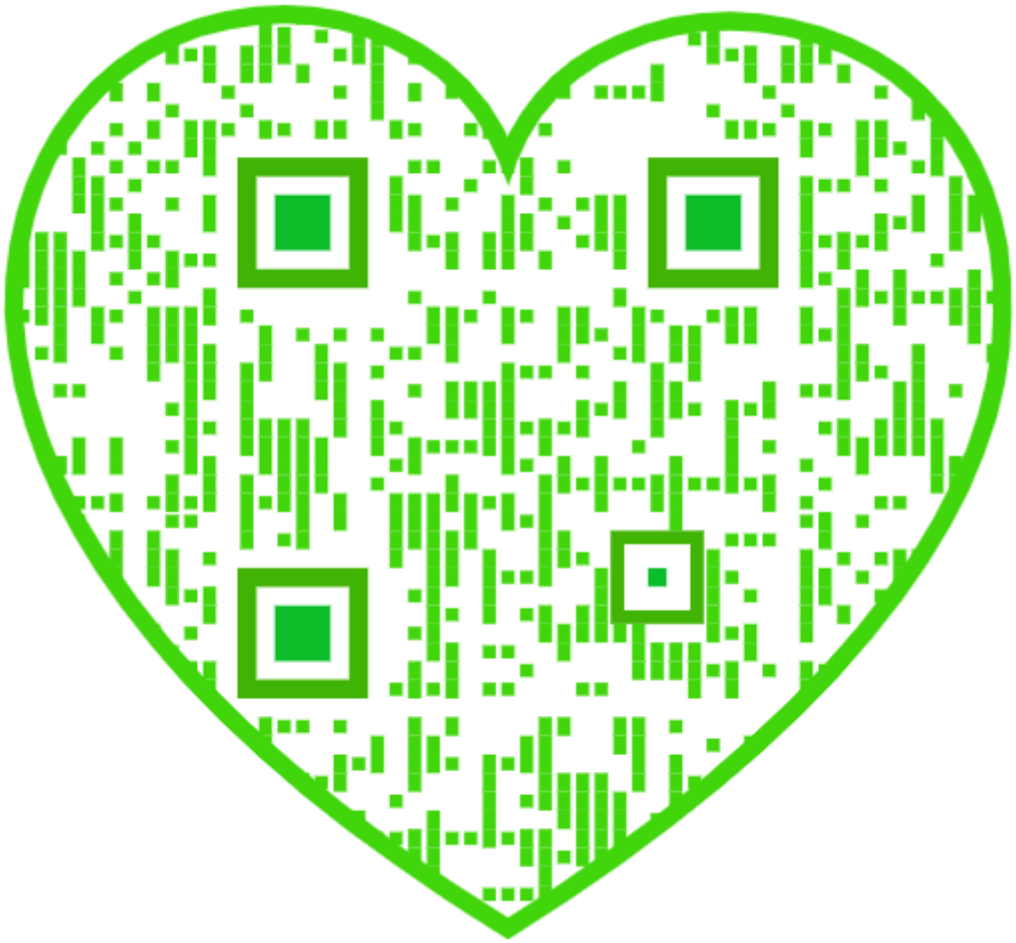
Fig. 1.—Side Elevation of Engine. Fig. 2.—Front Elevation of Valve Gear. (Fig. 2 *a* is part of Fig. 2, and connects at *x x*. It is shown thus to save space.)

## A MINE ENGINE.

BY MUNIO.

THE accompanying drawing, Fig. 1, is a side elevation of an engine which is often used at the coal and ironstone mines for drawing the materials to the surface, and in some cases for pumping at the same time. These engines are sometimes of large size. The one represented has a cylinder 40 in. in diameter, and 6 ft. 6 in. stroke; the winding drum is 14 ft. in diameter, and the fly-wheel is 23 ft. 6 in. in diameter. The walls of the engine-house are built very strong and massive, and form a support for the beams and one end of the crank-shaft; the other end of the shaft rests on an oak beam, the ends of which are fixed in the walls of the engine-house. Underneath this beam, and as an additional support, is fixed an iron girder, supported from the floor level by two cast-iron columns. These are not shown in the drawing.

The motion of the piston-rod is guided by two beams, the ends of which are fixed on bearings bolted into the walls of the house; these are sometimes made of cast iron, and sometimes of wrought iron. Those shown are of wrought iron, with two plates at each side about 3 in. apart; the two sides are strongly



bolted together, the full width outside being 2 ft. 8 in. The larger beam carries a connecting-rod, which is fixed to a beam below the floor for working a pump.

The two beams are connected by links, to the centre of which is fixed the end of the connecting-rod and the piston-rod, the beams and links forming a parallel motion. Another link is fixed on the smaller beam, to the centre of which is attached a pump-rod, which also works the hand-gear.

The winding drums have cast-iron sides keyed on the fly-wheel shaft, and cleaded inside with strong wooden cleading for the ropes to coil on.

On the rim of the fly-wheel is fixed a very powerful brake, which can be brought on by the foot of the man at the handles. As the engine has to be stopped and reversed each time the load is brought to the surface, the means for accomplishing this must be made as light as possible. The steam and exhaust-valves are made circular, and are called double mitre-valves, being arranged to admit steam both at the upper and under side when open. They are worked by rods and levers attached to two rocking-shafts on which are levers ; these levers are raised and lowered by tappets on the pump-rod.

Fig. 2 is a front elevation of the gearing for working the valves. The steam-pipe is on the left and the exhaust-pipe on the right-hand side ; these are connected to chambers at the top and bottom of the cylinder, in which are fixed the steam and exhaust-valves. To the top of these valves is fixed a rack working in a guide ; this rack is worked by a toothed segment fixed on a shaft. The end of this shaft projects to the outside of the chamber, and has a lever fixed upon it, which is connected by a rod to another lever keyed on the rocking-shaft. The top rocking-shaft is connected to the top steam-valve and lower exhaust-valve, and the lower shaft to the lower steam-valve and the top exhaust-valve. Balance-weights are fixed to levers on the end of each rocking-shaft, which have a tendency to close the valves.

Between the rocking-shafts is fixed a pawl or catch, into which a cam on each rocking-shaft can be fixed. When the handles are both fixed in the catch, and in a horizontal position, as shown, all the valves are closed, and the engine is stationary ; but when one of the handles is moved out of the catch, the engine makes half a revolution, and, the tappet on the pump-rod coming into contact with the lever on the other rocking-shaft, it opens the steam and exhaust-valve connected to that shaft, the action of the pawl and balance-weight at the same time closing the valves which had previously been open, the tappets then alternately opening the valves, and keeping the engine in motion.

A signal bell is arranged to ring when the load is near the surface, which is worked by a cord wound on the fly-wheel shaft. The last stroke or two is worked by hand, and the engine finally stopped by means of the brake. Some of these engines will raise 1,000 tons of materials per day from a depth of 100 fathoms.

It is desirable to remind the reader that the diagram marked Fig. 2*a* is really a portion of Fig. 2, and connected with it at the line *x x*. It has been removed and shown separately to enable Figs. 1 and 2 to be drawn on a larger scale, and their different parts to be expressed more clearly than they could have been had Fig. 2*a* been attached to Fig. 2 and drawn in its proper place. All mechanical drawings should be, and are, in Work, shown on as large a scale as possible

## MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

Electric Light Fittings—Conducting Wires—Switches—Cut-Outs—Switch-Boards—Universal Switch-Boards—Measuring Instruments—Lamps and Lamp-Holders—Electroliers—Care of Lamps and Batteries—Concluding Remarks.

*Electric Light Fittings.*—Although provided with incandescent lamps, generators for the electric current, and secondary generators in case of accident, there are still many accessories necessary to constitute an electric light installation. Suitable wires or cables for the main conducting lines, suitable wires for the branch lines, switches for turning the current on to the lamps or off from them, apparatus to protect the filaments of the lamps from excess of current, lamp-holders, stands, and pendants, governors to control the charging current supplied to accumulators, together with instruments for determining the pressure and volume of the current, represent the main necessary accessories of an electric light installation.

*Conducting Wires.*—Before any person can decide upon the length and size of the conducting wires required for an installation of electric light, he must know exactly the number of lamps desired, and their respective candle-power, as also the extreme distance of the farthest lamp from the dynamo or battery. He must also decide on a system for arranging the lamps. The lamps may be arranged in parallel—that is, as shown in Fig. 71, where each lamp forms a branch of the main circuit. In this case, there are two main wires, named "leads," running from the dynamo to the extreme limit of the installation, and a branch pair of wires running from the main wires to each lamp. Each lamp will take a definite volume of current at a certain potential, and the required volume for the whole will be ascertained by multiplying the volume needed for one lamp by the total number of lamps likely to be used. For instance, supposing ten 8 c.p. lamps taking two ampères of current per lamp are to be used, the current required will be $2 \times 10 = 20$ ampères, and we must employ main wires capable of safely carrying twenty ampères of current. This may be found on reference to the table given on the next page, which shows at a glance the safe carrying capacity of all likely main wires and cables. The branch wires in this instance need only have a safe carrying capacity of two ampères, since one pair of wires will only carry current to one lamp.

The lamps may be arranged as shown at Fig. 72, which may be described as parallel series. In this system the same main leads will be required, but the current must be delivered at a higher potential to overcome the extra resistance of lamps placed in series. In such an arrangement, the branch wire is connected to the main, then on to one lamp, from this to the next, and then back to the main again.

If the current is small, but of high potential, or, if the lamps have a low resistance, as in the Bernstein lamps, the lamps may be arranged in series as shown at Fig. 73. In this arrangement, one thin wire only need be carried from the generator to the series of lamps, and then back to the generator again. This system has several disadvantages which more than counterbalance their simple arrangement. If Edison-Swan lamps are employed, they must all be marked with the same reference letter, and should require the same number of ampères each lamp. If the lamps are not provided with an automatic switch to each lamp, the whole series will be extinguished if the filament of one lamp in the series should break. The high pressure required to send current through all the lamps is an element of danger in a house, involving extra fire risks and possible accidents from shocks received in handling the fittings. The E.M.F. needed to send the necessary current through ten lamps having a voltage of fifteen volts each lamp, will be $10 \times 15 = 150$ volts if arranged in series. But, if the lamps are arranged in parallel, as shown at Fig. 71, we shall only need an E.M.F. sufficiently high to overcome the resistance of one lamp and the branch wires, in addition to that of the mains, about seventeen volts in all. In the arrangement shown at Fig. 72, the voltage of any series of the lamps must not exceed the E.M.F. of the current, and the volume of the current must be proportioned to the same total of all the series.

The table at the top of the next page will show the safe carrying capacity of electric light wires and cables. The wires and cables mentioned in the table are insulated with one coat of cotton, waxed with paraffin, then with one lap of pure indiarubber, covered with prepared cotton tape, then coated with braided cotton covered with a preservative compound. Thicker insulation can be obtained at a higher price per yard, and quantities of one mile in length are sold at a reduced rate. It is best to use highly insulated wires for the mains and for the branches, and these should be laid with a small space between them to guard against possible accidental leakage. It will be found to be true economy to choose wires large enough to carry two or three times more current than the safety limit mentioned in the table on the next page, as resistance in the wires necessitates an expenditure of power to overcome it, and this is a waste of power. Not only should this receive consideration, but also the fact that when current is choked in the wires, the lamps do not burn equally bright. Cables are preferable to very large wires on account of superior flexibility. All joints must be made with long laps well soldered together, and well insulated afterwards with a good compound, such as Chatterton's compound, sold for the purpose, then coated with tarred tape. Merely twisted joints are very dangerous, as are also badly insulated joints. Where branch joints are made, and the branch wire crosses a main, special precautions must be taken in insulating the wires, as it is just at such points as these where overheating occurs, with consequent outbreaks of fire. I have given the safe carrying capacity of wire and cables up to 47·9 ampères, this being sufficient for a small installation of electric lights of, say, 150 candle-power, but I shall be pleased at any time to meet larger requirements by advising the sizes of cables or wires.

*Switches.*—If we are amusing ourselves with one lamp and a small battery, as described in the earlier papers of this series, it will not be necessary to have a switch. The lamp will be fixed and the wires connected to the terminals of the battery, from which current will be turned on to the lamp by lifting the solution to the plates or depressing these into the solution. But, for larger installations of more than one lamp, a switch to turn the current on to the lamps or off from them, when required, will be a necessity. In some of the Edison lamp-holders, this provision is made in each holder, which is furnished with a small switch to turn the current on and off by

TABLE SHOWING SAFE CARRYING CAPACITY OF COPPER WIRES AND CABLES.

| No. of Wire (Standard gauge). | Strands of Wire. | Safe carrying capacity in ampères. | Price per yard. | No. of Wire (Standard gauge). | Strands of Wire. | Safe carrying capacity in ampères. | Price per yard. | No. of Wire (Standard gauge). | Strands of Wire. | Safe carrying capacity in amperes. | Price per yard. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 1 | ·6 | 1d. | 23 | 7 | 3.2 | 2¼d. | 10 | 1 | 12·8 | 0s. 6d. |
| 21 | 1 | ·8 | 1¼d. | 15 | 1 | 4·0 | 2½d. | 18 | 7 | 12·8 | 0s. 6½d. |
| 25 | 3 | ·9 | 1¼d. | 22 | 7 | 4·4 | 3d. | 9 | 1 | 16·2 | 0s. 7½d. |
| 20 | 1 | 1·0 | 1¼d. | 14 | 1 | 5·0 | 3d. | 17 | 7 | 17·4 | 0s. 8½d. |
| 19 | 1 | 1·2 | 1½d. | 21½ | 7 | 5·0 | 3¼d. | 8 | 1 | 20·1 | 0s. 9d. |
| 23 | 3 | 1·4 | 1½d. | 20½ | 7 | 6·1 | 3¾d. | 16 | 7 | 22·9 | 0s. 11d. |
| 18 | 1 | 1·8 | 1¾d. | 13 | 1 | 6·6 | 3¾d. | 19 | 19 | 24·3 | 0s. 11½d. |
| 22 | 3 | 1·9 | 2d. | 20 | 7 | 7·2 | 4¼d. | 15 | 7 | 28·9 | 1s. 1d. |
| 25 | 7 | 2·2 | 2¼d. | 12 | 1 | 8·5 | 4¼d. | 18 | 19 | 34·9 | 1s. 4d. |
| 17 | 1 | 2·4 | 2d. | 19 | 7 | 8·9 | 5d. | 14 | 7 | 35·6 | 1s. 4d. |
| 16 | 1 | 3·2 | 2¼d. | 11 | 1 | 10·5 | 5d. | 17 | 19 | 47·9 | 1s. 9d. |

means of a tap similar to that of a gas tap. This is shown at Fig. 74. A small switch capable of adaptation to other holders is shown at Fig. 75. These are convenient appliances for single lamps; but lamps are frequently arranged in groups, each group being supplied with current from its own branch; and each branch must be provided with a switch, so that each group may be switched out of circuit when not required. We cannot turn down electric lights as we turn down gas and oil lights, so must turn them off when the light is not wanted. If we wish to have a reduced light in a room, provision must be made for this when laying the wires by having an independent branch running to one or two lamps, and these may be of lower candle-power than the others.

Switches for electric light installations differ from those employed in electric bell work in being of a more massive design and more carefully constructed. Almost any simple means of ensuring contact between two parts of the circuit will serve for the purpose of electric bell work, because the current is small, rarely exceeding 1 ampère at a pressure of not exceeding 6 volts. But the lowest electric light current exceeds this, and those of any magnitude will be some ten or twenty times stronger. It is well known that a spark passes between the two parts of a switch in a bell circuit, and it is necessary to protect the contact surfaces with platinum to prevent burning of those surfaces. A still larger spark passes when contact is made and broken in an electric light circuit, and this spark will burn away platinum-protected surfaces. It is therefore necessary to have massive pieces of brass, with long and perfectly bearing surfaces, for the contact pieces of electric light switches, to prevent heating and consequent burning of the surfaces when the spark passes. The metal in the switches must be adapted to the current they are intended to carry, as it would be manifestly unwise to use a 10-ampère switch in a circuit to carry 20 ampères of current. I cannot stay to notice all the switches now in the market, but will sketch some of them. Fig. 76 shows a simple bar switch with clutch action, mounted on a base of hard wood, slate, serpentine, or china. The working parts are of brass, the handle of hard wood or of ebonite. These are made to carry main currents varying from 25 to 80 ampères, according to dimensions of brass employed, and are sold at from 5s. 9d. to 16s. each. Fig. 77 shows another form of this switch for switching the current from one branch to another. Fig. 78 shows a small main or branch switch made to carry from 25 to 50 ampères of current, and sold at from 10s. to 17s. 6d. each. Fig. 79 shows a massive form of main switch to carry from 50 to 150 ampères of current, and sold at from 17s. 6d. to 33s. each. For heavier currents, brush contact switches are made, in which bunches of phosphor-bronze ribbon are used on the ends of the arms to make contact with the brass pieces below. Figs. 80, 81, 82, 83, 84, and 85 show some forms of ornamental branch switches suitable to prominent and exposed positions. These vary in price from 2s. 6d. to 6s. 6d. each. When portable table lamps are employed in an installation, contact is made by means of wall sockets and plungers, as shown at Fig. 86. The socket-holder is let into the wall after the branch wires have been soldered to the sockets. These cost from 3s. 6d. to 10s. 6d. each. When it is desirable to have the lamp suspended from the ceiling of a room by a flexible cord, contact is made with the branch wires by means of ceiling roses, such as those shown at Figs. 87, 88, 89, and 90A. The prices are from 1s. to 3s. 6d. each.

*Cut-Outs.*—Should an engine race whilst the dynamo is connected to the lamps, the current would be suddenly augmented, and this sudden rush of current through the lamps might cause total disruption of their filaments. To protect the lamps from this and similar accidents, an extra appliance is attached to each switch or inserted as a separate apparatus into each branch of the circuit. This appliance is named a "cut-out," because by its action it cuts the protected part out of circuit whenever the current rises to a dangerous height. A cut-out is simply one or more short pieces of fusible tin wire inserted into the circuit. These may be enclosed in a ceiling rose such as that shown at Fig. 87, or mounted on a separate base of wood, slate, or china, as shown at Figs. 90 and 91. A 1 in. length of No. 20 fusible tin wire will carry safely from 2 to 3 ampères of current, but melt if the current is raised to from 3 to 4 ampères. It will thus protect one lamp, and one such piece to each lamp will protect many from injury. Larger cut-outs are made, up to a 1,000-ampère capacity, for the protection of lamps and buildings by including them in the main circuit. The fusible wires cost from 3s. to 5s. per pound, according to their fineness, and the cut-outs complete cost from 1s. for a 1–5 ampère capacity, up to £5 for those of more massive and elaborate construction, capable of carrying 1,000 ampères.

*Switch-Boards.*—In large installations of electric lights, it is found advantageous to mount all the switches and appliances on one board, where they can be easily seen and attended to in case of accident. Such a board is shown at Fig. 92, on which is mounted the switches belonging to the dynamo and accumulator mains A and D, the main lamp circuit switch in the centre at L, an ammeter and voltmeter, with their respective keys, and a multiple cut-out for the main circuit. The board is of polished walnut, with bright brass fittings. Fig. 93 is a design for a branch switch-board, to be placed in a glass case on the wall of a corridor or passage.

*Universal Switch-Boards.*—The adjoining sketch (Fig. 94) represents the plan of connections employed in the Universal Switch-board made and sold by Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham. The board is a large slab of enamelled slate, fixed in a moulded and polished teak frame, on which are mounted the switches on polished serpentine bases. The letters P N indicate the positive and negative mains from the dynamo; L L are the two terminals of the main lamp circuit; A is the ammeter; V, the voltmeter; and M, the magnetic cut-out for the accumulator. This is a necessary accessory when accumulators are employed on a lamp circuit in connection with a dynamo. The magnetic cut-out is shown separately at Fig. 95. This is so constructed as to close the circuit between the dynamo and the accumulators when the E.M.F. of the current is maintained at the requisite height, but it breaks the circuit when the E.M.F. falls below a certain fixed point, and thus prevents short-circuiting of the dynamo by the back E.M.F. of the accumulator cells. Connections are made at the back of this switch-board, and the wires are shown on the sketch by dotted lines. These will give some idea respecting the method adopted in making switch-board connections, all wires or flexible cables being well insulated.

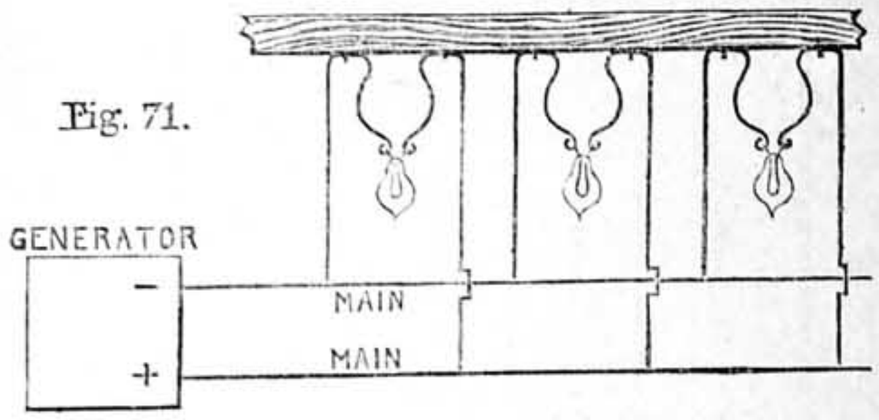
It may be just as well here to note that all connections between wires and switches should be either soldered or sweated into the contact pieces, or soldered into thimble-and-eye terminals to be fitted on to the contacts by bolts and nuts.

*Measuring Instruments.*—The measuring instruments employed in electric lighting are, an ammeter, to measure the strength and volume of the current; and a voltmeter, to measure the E.M.F. I give illustrations of the gravity form of these instruments at Figs. 96 and 97, these being more reliable than any other. In the ammeter a stout coil of wire is wound on a core of soft iron, which is converted into an electro-magnet when the electric current passes through the coil. The magnetised iron then attracts a light iron rod attached to an arbor, on which is mounted a counter-weight and index hand. In the voltmeter a finer coil serves a similar purpose. These instruments cost from £3 10s. to £8 each, and are made to register from 60 volts or ampères up to 1,000 volts or ampères, as may be required. The ammeter and voltmeter shown in Fig. 92 are the Schuckert ampère and voltmeter, the construction of which varies slightly from that of the gravity instruments.

*Lamps and Lamp-Holders.*—A few years ago there were many forms of incandescent electric lamps to be seen and obtained, but most of these have been placed *hors de combat* in the battle of patent rights, and only those of the richest monopolists remain to illustrate the doctrine of the survival of the fittest, the weakest men—not necessarily the weakest lamps—having gone to the wall.

Among the survivors, the Edison-Swan holds its own, and I herewith give three illustrations showing the three types of sockets sold with these lamp bulbs. Fig. 98 shows the B. C., or brass collar lamp, furnished with a brass collar for fixing on the patent No. 14 holder shown at Fig. 101. Fig. 99 shows the E. S., or Edison socket lamp, with screwed collar to fit in the Edison socket-holder. Fig. 100 shows

Fig. 71.



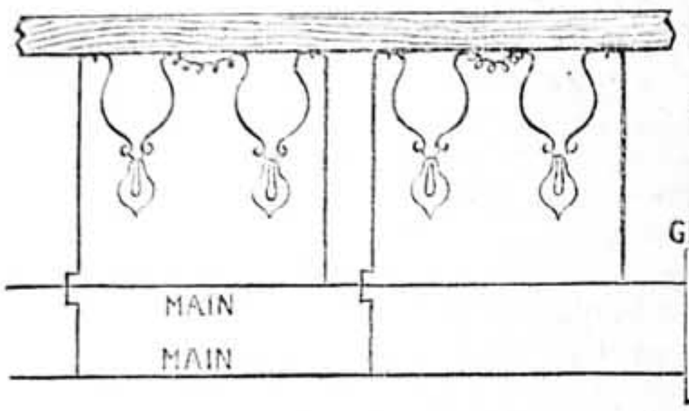
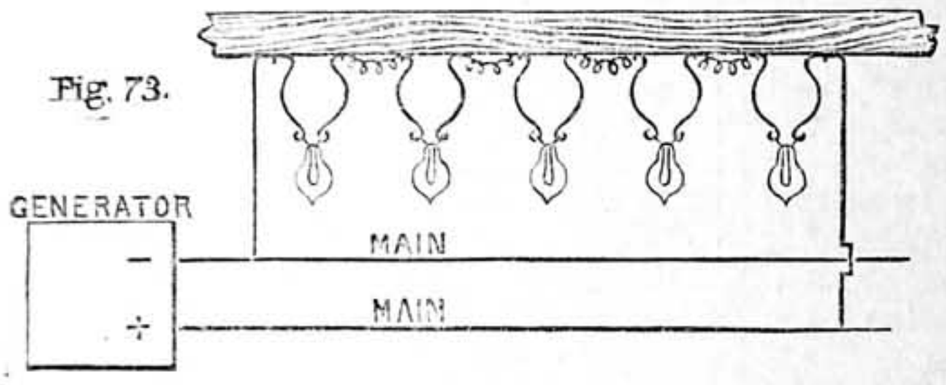




Fig. 72.

Fig. 73.



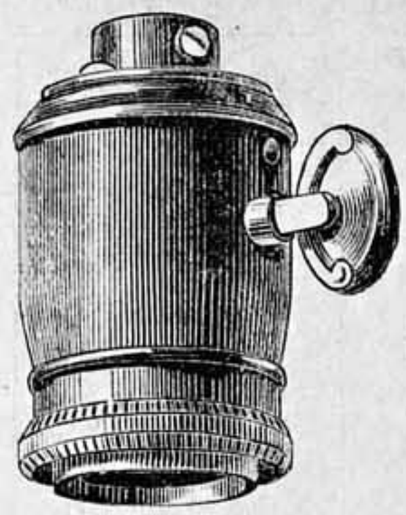



Fig. 74.

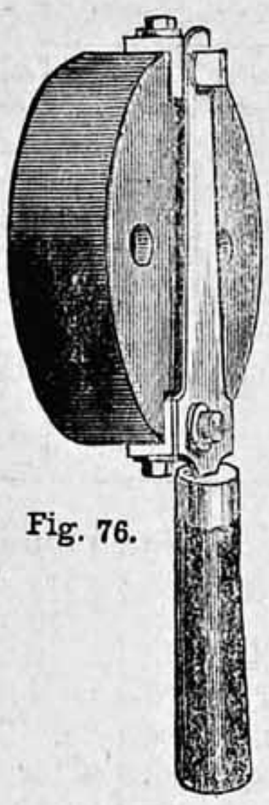


Fig. 76.

Fig. 77.

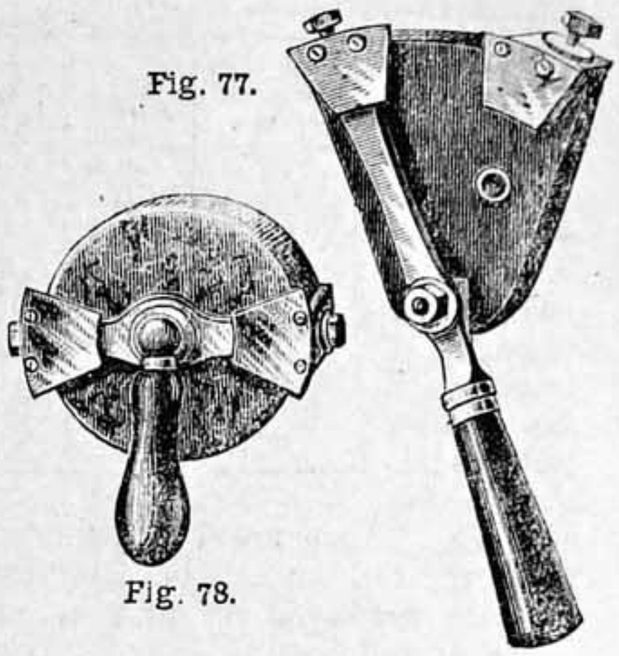


Fig. 78.

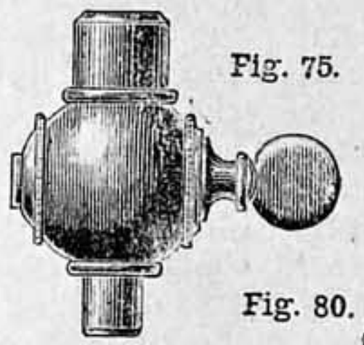


Fig. 75.

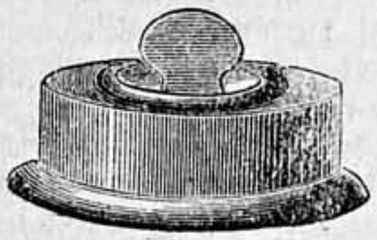


Fig. 80.

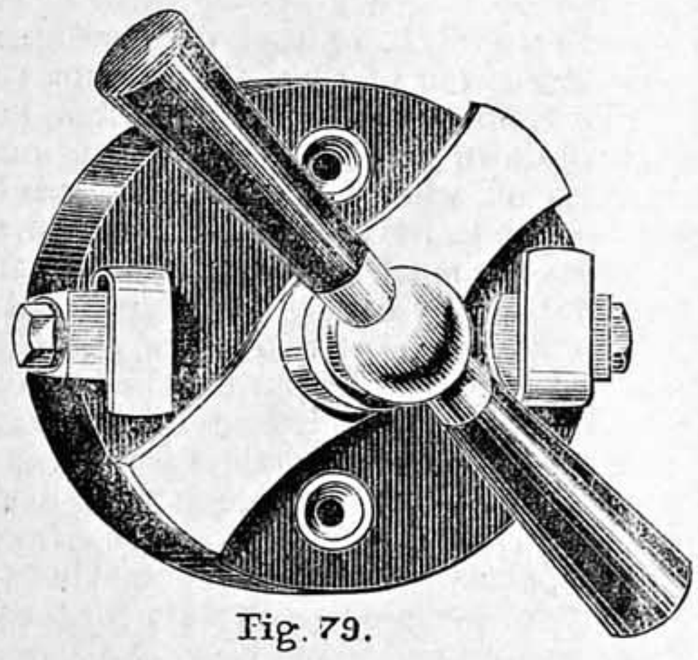


Fig. 79.

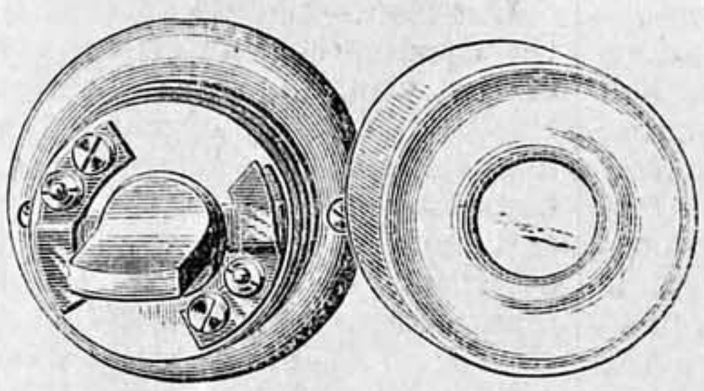


Fig. 81.

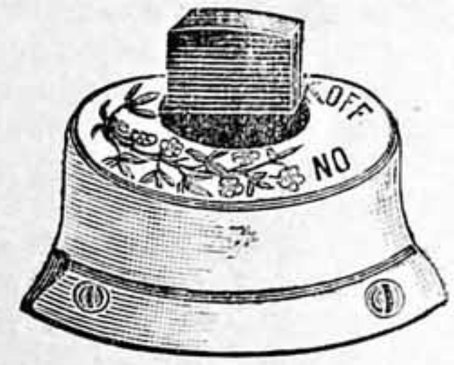



Fig. 85.

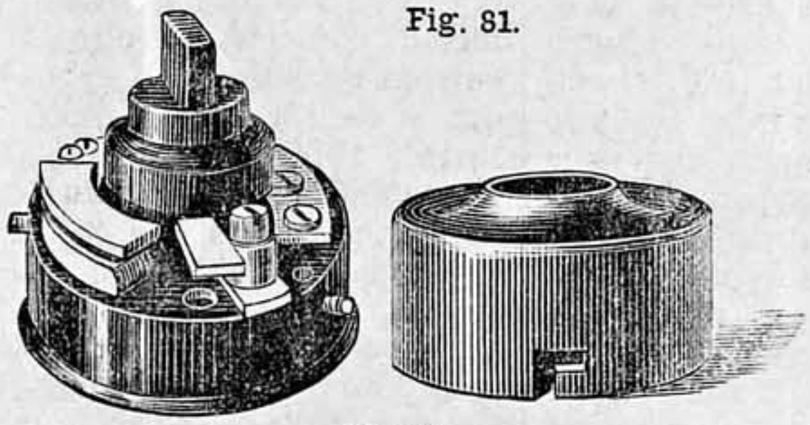


Fig. 84.

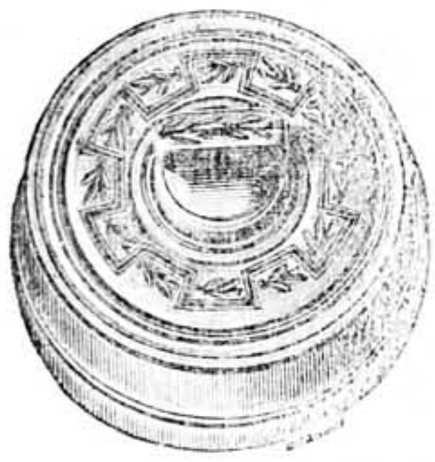


Fig. 82.

Fig. 83.

Fig. 89.

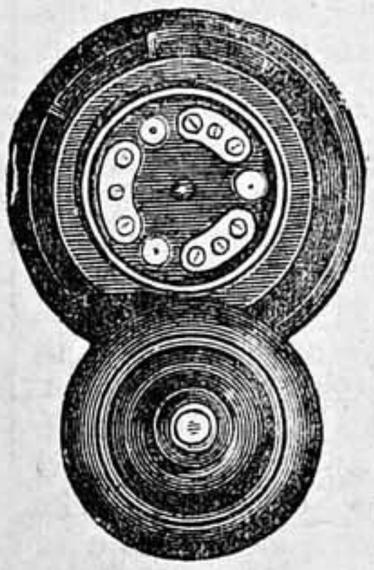


Fig. 87.

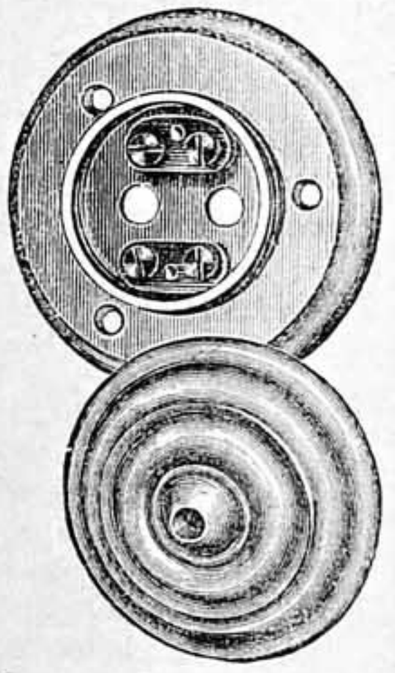


Fig. 88.

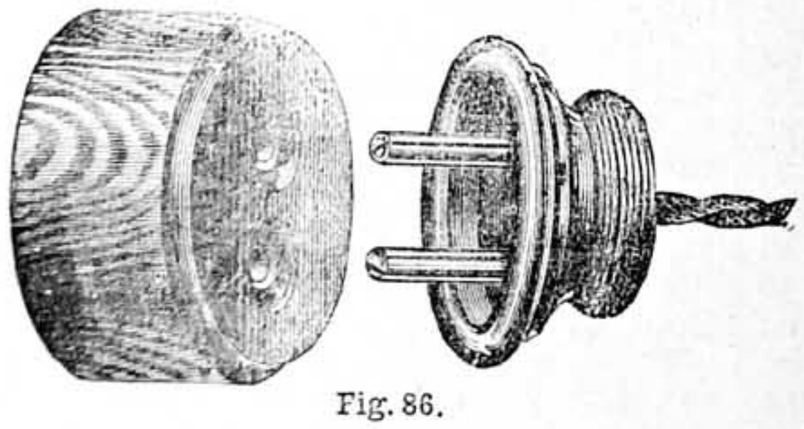


Fig. 86.

Fig. 90 A.

Figs. 71, 72.—Plans showing how to connect Electric Lamps in Parallel Series. Fig. 73.—Plan showing how to connect Electric Lamps in Series. Fig. 74.—Lamp-Holder and Switch. Fig. 75.—Lamp Switch. Figs. 76, 77, 78, 79.—Main Line Switches. Figs. 80, 81, 82, 83, 84, 85.—Branch Switches. Fig. 86.—Wall Plug and Socket. Fig. 87.—Ceiling Rose and Contact. Figs. 88, 89, 90.—Ceiling Roses. Fig. 90 A.—Cut-Out Circular Pattern. Fig. 91.—Slate Base Contact. Fig. 92.—Main Switch-Board. Fig. 93.—Corridor Branch Switch-Board. Fig. 94.—Plan of Universal Switch-Board. Fig. 95.—Magnetic Cut-Out. Fig. 96.—Gravity Voltmeter. Fig. 97.—Gravity Ammeter. Fig. 98.—Edison-Swan Incandescent B. C. Lamp. Fig. 99.—Ditto E. S. Lamp. Fig. 100.—Ditto B. L. Lamp. Fig. 101.—Edison Lamp-Holder. Fig. 102.—Snake Pattern Lamp-Holder. Fig. 103.—Gas Bracket China Lamp-Holder. Fig. 104.—Amateur's Lamp-Holder: Section. Fig. 105.—Wire for Pendant Lamp-Holder. Fig. 106.—Amateur's Table Standard Lamp-Holder. Fig. 107.—Wire for Table Standard Lamp-Holder. Fig. 108.—"Drawing-Room" Pendant Electrolier. Fig. 109.—"Elevator" Pendant Electrolier. N.B.—Figs. 90–109 are given in the next page.

the B. L., or bottom-loop lamp, with plain bottom loops easily adapted to the wants of amateur users.

The usual Swan lamp-holders are made similar to the holder shown at Figs. 102 and 103, but with a spiral brass spring to keep the lamp loops in contact with the hooks of the conducting wires. A holder fulfilling all the conditions of this last may be made by the amateur himself, as shown at Fig. 104. A cone of $\frac{3}{4}$ in. in length and $\frac{5}{8}$ in. in diameter is turned out of hard wood or ebonite, with a deep groove forming a ring around its base to receive one convolution of a brass spiral spring. Two holes are drilled through this to receive two short pieces of No. 16 copper wire. These are thrust through the wood cone, and their ends fitted and soldered into two spirals of No. 20 hard-drawn copper wire, furnished with two hooks for the loops of the lamps. A spiral of hard-drawn brass wire of No. 18 gauge, large enough to encircle the neck of the lamp, is now to be fitted to the holder,

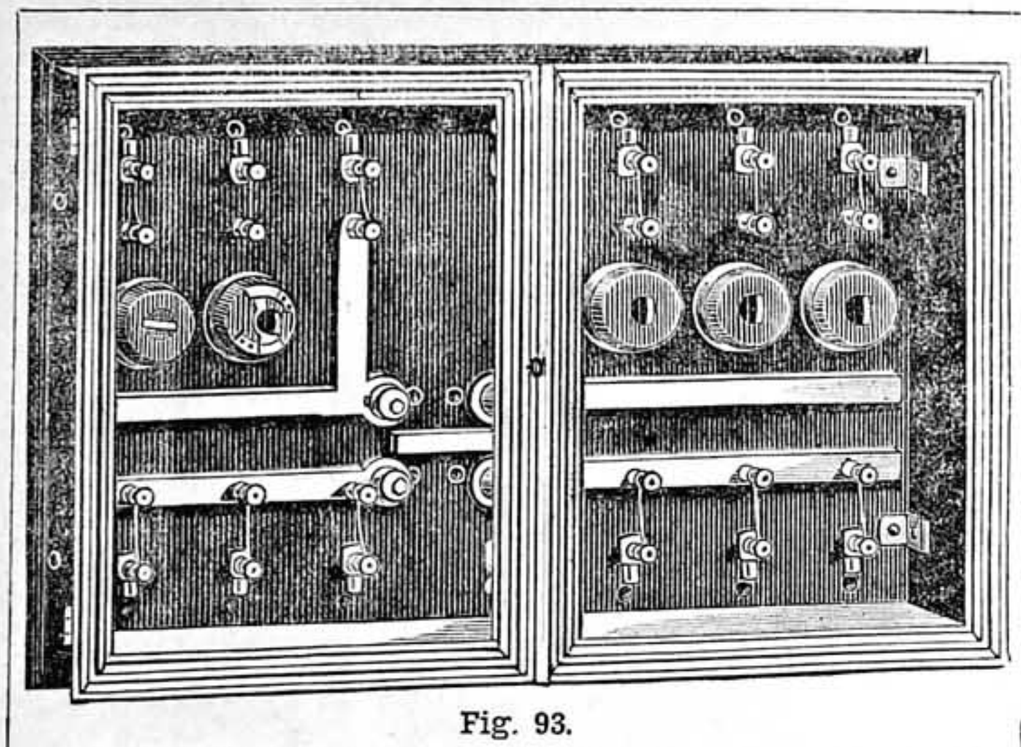


Fig. 93.

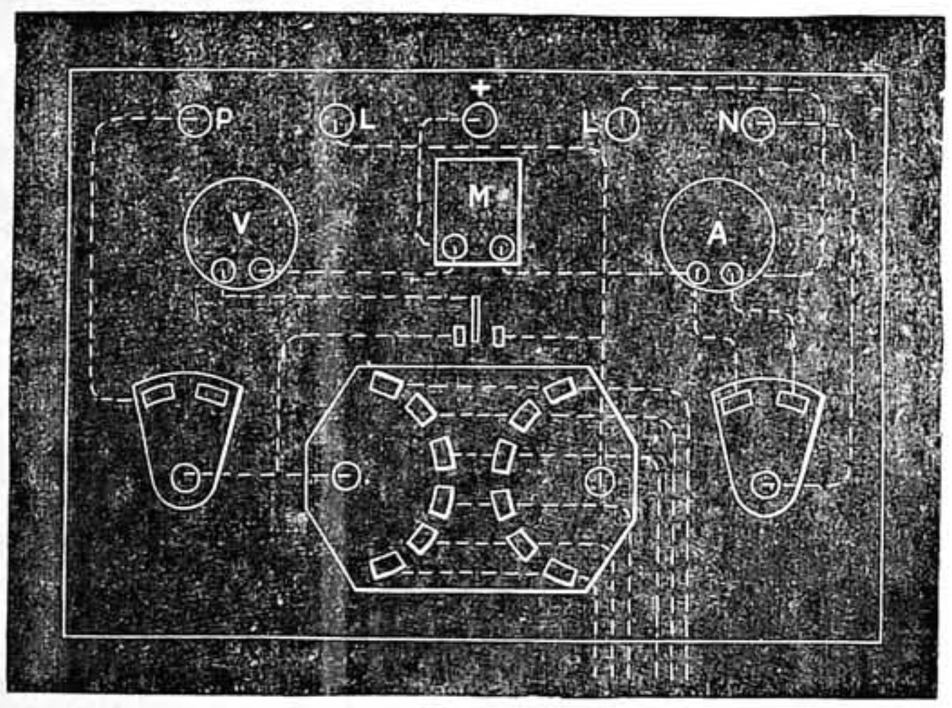



Fig. 94.

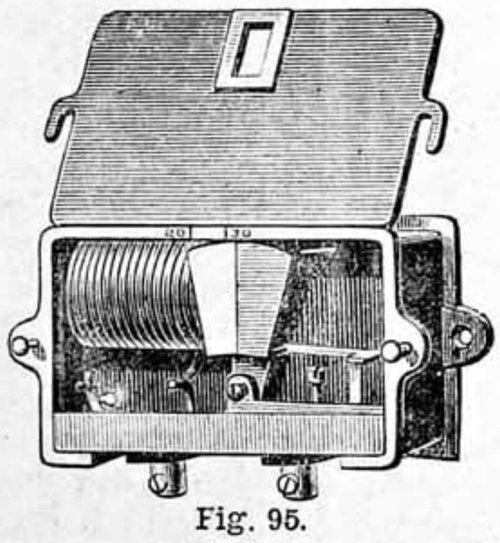


Fig. 95.

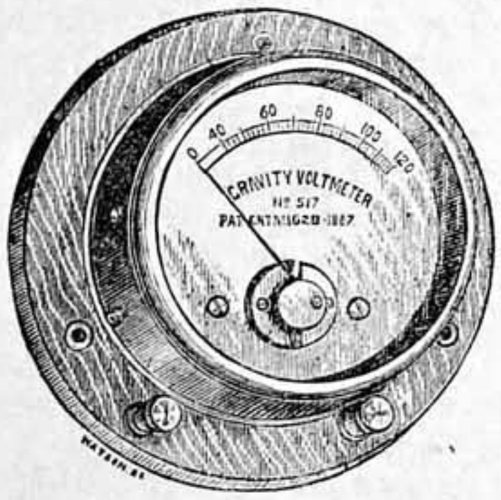



Fig. 96.

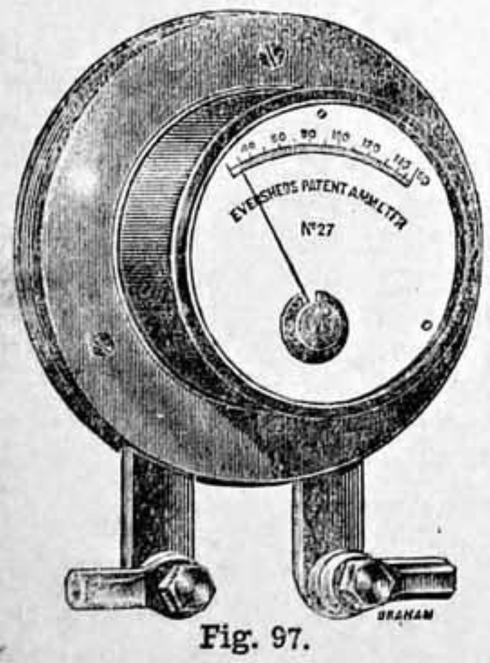
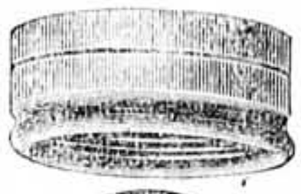



Fig. 97.



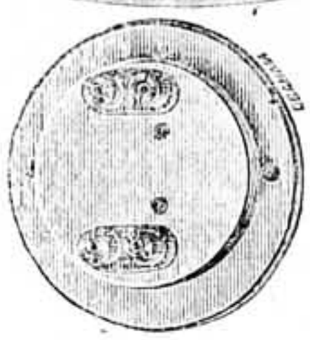


Fig. 90.

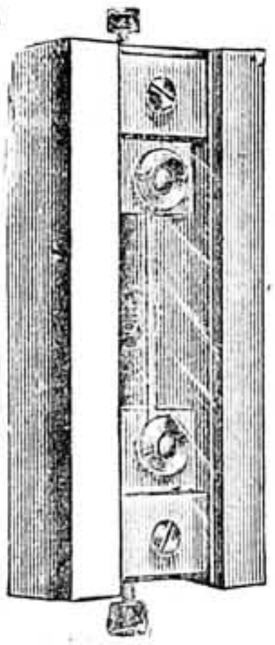


Fig. 91.

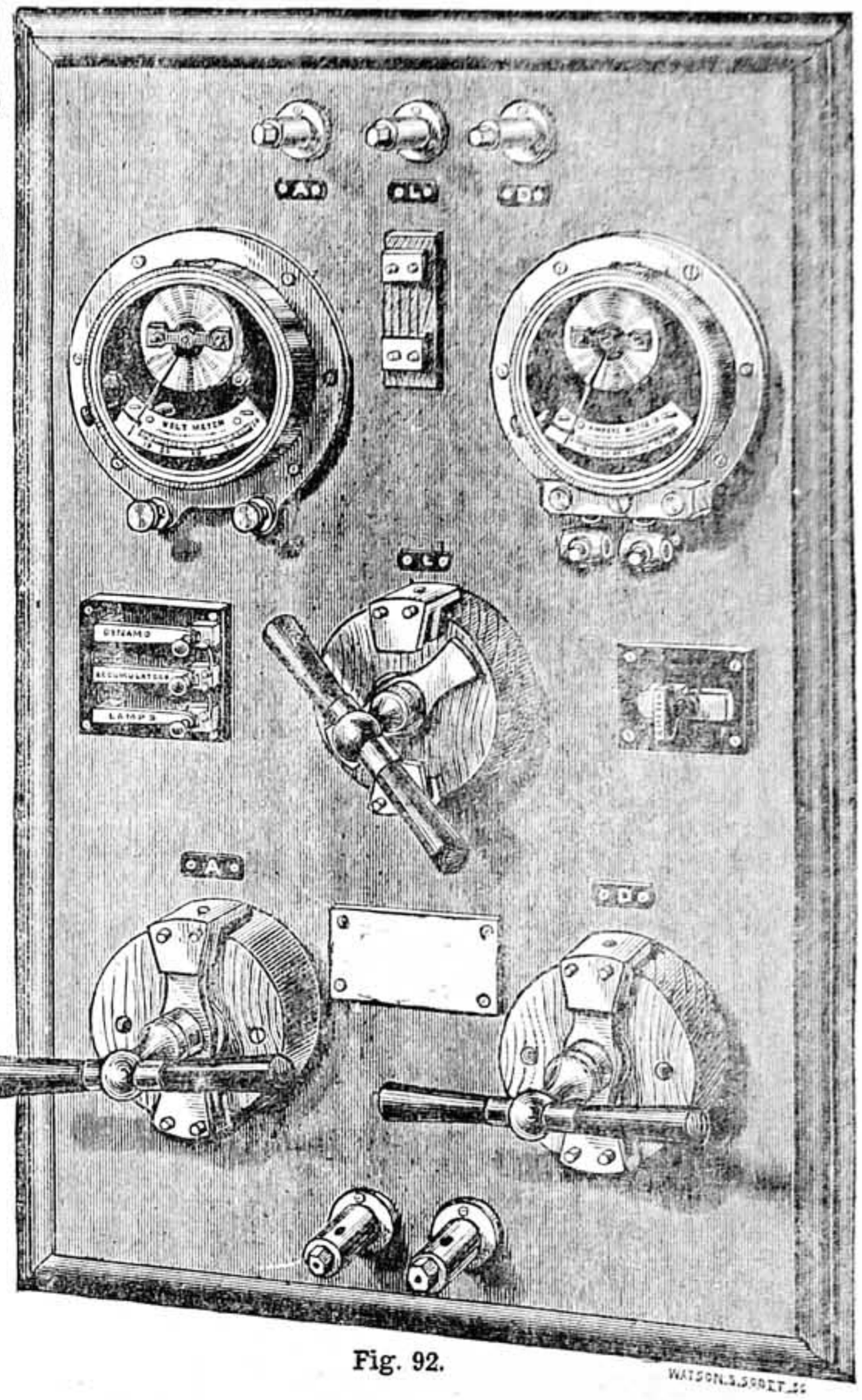



Fig. 92.

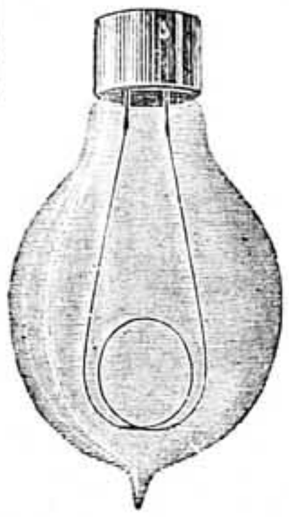


Fig. 98.

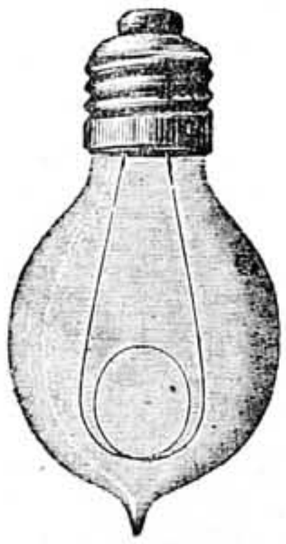


Fig. 99.

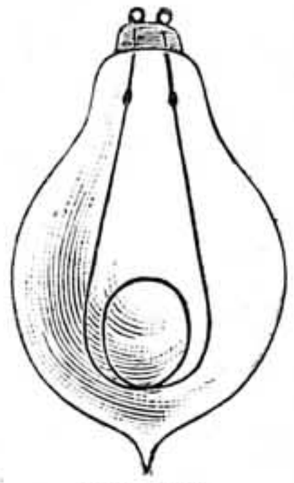


Fig. 100.

Fig. 105.

Fig. 107.

Fig. 108.

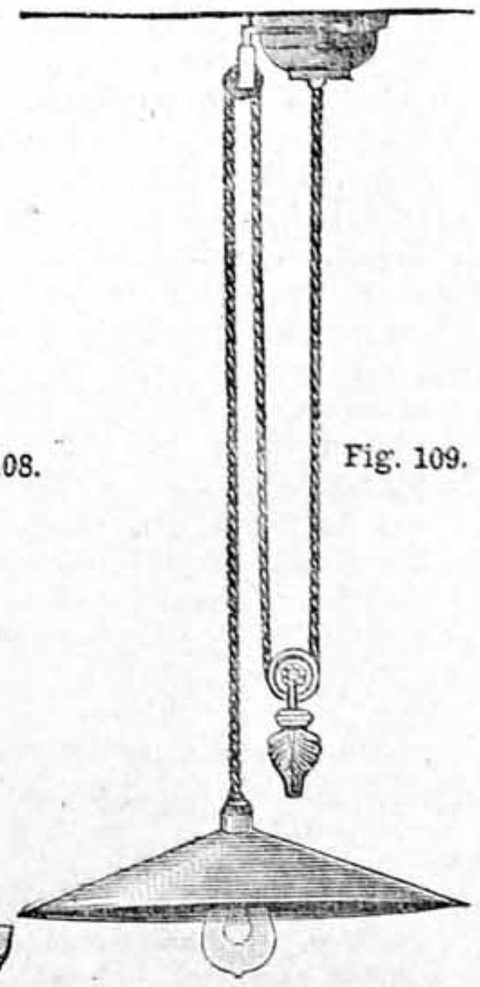


Fig. 109.

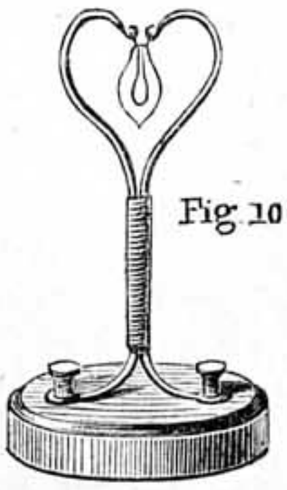


Fig. 106.

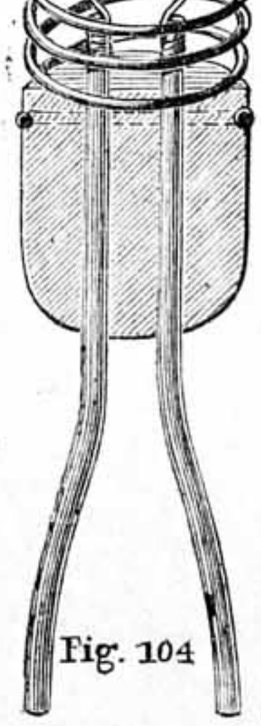


Fig. 104

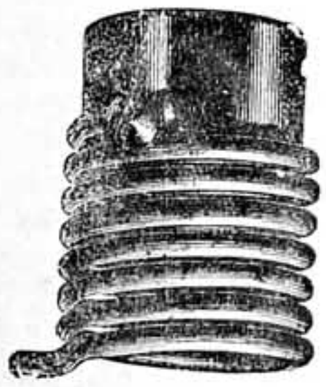


Fig. 102.

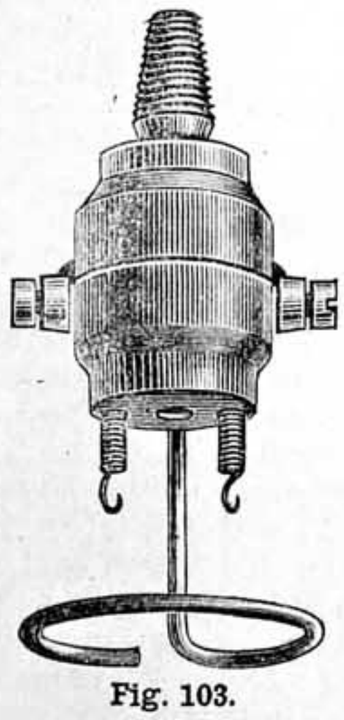


Fig. 101.



Fig. 103.

when it will be complete. The two projecting wires may be soldered to the branch wires leading from the main, or may be connected to them by screw connectors.

An idea for a simply constructed inexpensive lamp-holder comes to us from the *Scientific American*. Its adaptability to the amateur's workshop is shown at Figs. 71, 72, and 73. It is made of two short pieces of hard-drawn brass, copper, or coppered wire, bent to the shape shown at Fig. 105, and attached by brass screws, at a suitable distance apart, to any wooden support. The lamps may be looped to this direct or by means of a short piece of finer wire, as the springy nature of the wires in the holder serve to keep its hooks in contact with the loops of the lamp. The adaptability of this idea to a table-lamp is shown at Fig. 106. The wires to form the standard are bent as shown at Fig. 107. They are then fixed to the wooden stand by means of binding screws. A long length of silk ribbon or of paraffined tape wound around each serves to insulate them from each other, and the whole is then bound together with twine or silk cord. The wires for these holders may be of from 15 to 18 gauge, but should be hard-drawn.

*Electroliers.*—These are the larger holders for electric lamps, corresponding with chandeliers for candles, and gaseliers for gas. They are made in many designs and in qualities to suit many prices. Some of the designs are marvels of ingenuity in ornamental metal work and cut glass, since they admit of material and workmanship impossible in gaseliers. I can only give illustrations of a few pendants. These are coming into favour for house lighting, because of their originality of design, introducing something different from that of gas-light and candle-light holders. The "drawing-room" pendant (Fig. 108) consists of a china "ceiling rose" furnished with a cut-out, from which depends a flexible twin-wire cord, connected to a china suspension holder, under a figured or cut glass shade. These are made for one lamp at 5s. 6d. each, or for two lamps at 7s. 6d. each. The "elevator" pendant (Fig. 109) is suitable to the study or office. It consists of a 3½ in. ceiling rose, with cut-out and separate pulley, over which runs a flexible twin cable made of thirty-five strands of No. 40 wire, holding a counter-weight, lamp-holder, and 10 in. opal shade. This is made and sold for one lamp at 10s. 6d., two lamps at 12s. 6d., or three lamps at 15s. A large variety of shades in cut and figured glass are admissible with pendants.

*Care of Lamps and Batteries.*—Incandescent lamps are expensive luxuries when carelessly used, as they are very fragile and soon break. Their delicate filaments of carbon are soon broken by sudden rushes of current; therefore it is always advisable to have a fusible cut-out to each lamp, such a cut-out only costing a few pence. Even when thus protected, the current from batteries and accumulators should be switched on gradually, adding cell to cell until the proper brightness of the lamps has been obained. Never short-circuit batteries or accumulators by spanning their terminals with a thick wire or other conductor having a large capacity. This is specially dangerous to accumulators, as the sudden rush of current is apt to ruin the plates by peeling off their coating. The rate of discharge should, therefore, be gradual, and never exceed four ampères per square foot of primary plate surface. Primary batteries will rarely bear a more rapid discharge than 3 ampères. In accumulators the pressure of the current gradually falls whilst being discharged, until it reaches an E.M.F. of 1·9 volts per cell, when discharge should cease and the cells be re-charged. At this time there should remain in the cells 25 per cent. of reserve force remaining from the original charge. A too rapid discharge buckles the plates and throws off the coating, and an excessive discharge causes the coat to absorb sulphuric acid and becomes a sulphate of lead, indicated by large white patches of a loose character on the surfaces of the positive plates. This is called "sulphating the cells."

*Concluding Remarks.*—In closing this series of papers on Model Electric Lights, I am conscious of only having touched the fringe of the subject in my foregoing remarks. Much remains to be said to treat this subject in only a fairly exhaustive manner, but I must close it now for want of space. I hope the papers will have been helpful to amateurs wishing to know something of electric lighting. In their preparation I have received assistance from Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham; Mr. A. Croft, Dover; and Mr. S. Bottone, Carshalton; to all of whom I beg to tender my most hearty thanks. Should any of my readers desire help in planning an installation, I shall be pleased to hear from them, and will reply to their letters through the medium of "Shop."

## HINTS TO WATCH WEARERS—AMATEURS AND OTHERS.

BY HERR SPRING.

In concluding my contributions to the present volume of WORK on the above subject, I desire to say a few words on the question of the chronometer balance. There is no greater nonsense and fallacy in the whole range of popular delusions concerning watches than the almost religious veneration with which the public regard the phrase "chronometer balance." One sees the phrase ostentatiously paraded on tickets attached to all sorts and conditions of watches hung in the windows of those who deal in the article. I have even seen a guinea watch, whose chief virtue was the possession of a "chronometer balance." But let me say at once that ninety-eight per cent. of so-called chronometer balances are useless; and of this percentage a very considerable proportion are not only useless, but absolutely pernicious. I am sorry to cut down this full-grown and flourishing popular delusion in this unceremonious fashion—but why cumbereth it the earth? People pay a few pounds for a watch described as possessing a "chronometer balance and ten jewels," and they imagine they have a horological treasure. In point of fact the balance is a useless fraud, and the jewels in all probability are common glass. To show the reason why a cheap watch cannot possibly possess a practicable chronometer balance I must enter into a little explanation, which shall be as untechnical as possible. The word "chronometer" balance is simply a synonym for "compensating" balance. Now, why is a chronometer balance used? It is used for this reason: every watch must have a hair-spring, which, by its expansion and contraction, keeps the balance-wheel swinging backwards and forwards. But the hair-spring, being made of fine steel, is delicately affected by the temperature—in heat it expands, and in cold it contracts. If any amateur wishes to demonstrate this, let him beg an old hair-spring from his watchmaker. Then let him place the spring—in the absence of anything more suitable—on the flat side of the blade of an old table knife, and hold the blade over a spirit-lamp or any small flame. As the blade becomes a little heated he will see the spring gradually uncoiling itself and growing larger. This is what happens in changes of temperature when the watch is in the wearer's pocket; only, of course, in a very much smaller degree. In a warm temperature the hair-spring expands and becomes weaker, and thus causes the watch to go slower. In a cold temperature, of course, the spring contracts, becomes stronger, and the watch goes faster. I am speaking now of a watch with a "plain" balance. But in order to compensate for these irregularities in the hair-spring the chronometer balance was applied. The rim of a chronometer balance is composed of a fusion of brass and steel, and is cut through in two places, so that instead of being an immovable circle, like the rim of a cart-wheel, the rim of a chronometer balance, when affected by the temperature, can move slightly inwards or outwards. The simple theory is, that when the hair-spring expands in heat the rim of the balance—owing to the two metals struggling with each other—contracts, and thus compensates for the conduct of the hair-spring, and keeps the watch up to time; when, on the other hand, the hair-spring contracts in cold the balance expands, and once more there is compensation. Now, whether a watch compensates or not in different temperatures depends on the capacity of the chronometer balance to counteract with great exactness the expansion and contraction of the hair-spring. But even in the case of the best chronometer balances it is absolutely necessary to experiment by placing the watch in some cold place (in winter the ordinary temperature may be sufficient; in summer it is necessary to use a refrigerator) for a certain set period, and afterwards to put it in an oven (made for the purpose) for an equal length of time. By comparing the result of this experiment it is easy to discover how far the compensation is wrong. The error is corrected by taking the balance out of the watch and moving the screws, which may be seen studded round the rim of the balance. It is not my intention at this moment to go into the question of compensation, and I have merely explained sufficient to make my meaning clear. What I wish to establish is that, even with a first-rate compensation, or "chronometer," balance it is absolutely necessary to experiment in hot and cold temperatures before one can be sure that the balance is not more injurious than beneficial to a watch. But I will venture to say that perhaps not more than two or three watches in a thousand are tested in this way. Yet there are thousands upon thousands of watches turned out of the factories with, as I said before, all the parade of the chronometer balance. Chronometer balances in all cheap watches are, unless by sheer accident, not only useless, but worse than useless. A first-rate chronometer balance costs, from the maker (counting nothing for its application to the watch and for compensation), one guinea. Those used on the average run of English-made silver watches cost one shilling. Those on the average English-made gold watch cost about two shillings. Neither of these would compensate if they were tried; and they are not tried. Hence, when the public purchase a watch possessing this wonderful chronometer balance, it is simply

a delusion and a snare. I will now show how an amateur may, with a little attention, test the compensation of his watch. The two temperatures in which he must try the watch should be about forty degrees apart from each other—not more than forty are necessary. How is he to get these two temperatures without an ice-box and an oven? Easily. Select a door beneath which there is a cold draught, and lay the watch on the floor in the draught. This will do for the cold temperature. For heat, use the fender or the hob, or any convenient place connected with the fire, where the temperature will not exceed, say, ninety-five degrees at the very utmost. I take it that you will thus get something like fifty-five degrees in cold, and about ninety in heat. Wind your watch carefully to the very top, set the seconds hand with some reliable timekeeper (the hand must be set at one spot on the dial—say exactly at the 60, because dials are always inaccurately divided), and then lay your watch on its back for six hours, and mark the variation by comparing it again with the reliable timekeeper. It is understood that you have an accurate thermometer lying beside the watch, and that you make a note of the temperature reached. Then wind up the watch once more, set it in a similar way, and place it in a convenient place, on its back, near the fire, together with the thermometer. At the end of six hours compare again for time, and you will find the error in compensation. It may be ten seconds slow in cold and ten seconds fast in heat—an error of twenty seconds in six hours, or eighty seconds a day. But unless you have a good balance in your watch you are absolutely helpless, for no alteration can be made in a sham balance. I would just add that when putting the watch near the fire a place should be selected where the heat will come very gradually and gently, and the thermometer should be observed every quarter of an hour, so that the heat may not be allowed to exceed ninety-five degrees. If the mercury should be rising rather rapidly, simply move the watch a few inches further away from the fire. With these observations I conclude my labours in connection with the present volume of this useful and interesting journal, and I can only hope and wish that my "hints" have done some little towards instructing and entertaining its readers.

## PARAFFIN LAMPS.

BY THOMASO.

LAMP FOR GAS BRACKET—LAMP FOR ORGAN OR PIANO—HANGING LAMP FOR SHOP—SHADES—FILLING CAN.

WE pass now to a different kind of lamp: one that can be screwed into any existing gas-fitting if the burner is removed. Fig. 39 gives a view of it. It is well suited for a bedroom or a dressing-room, in which case one each side of the chimney-breast would look well.

It is very similar to the lamps already described as far as materials and method are concerned. The reservoir is formed of half of one of the "shells" previously mentioned, with the edge cut off down to the arrow in Fig. 18 (page 696), and a circle of brass cut out to fit in. The burner is soldered on as usual, and three pieces of brass, like A, B, and C (Fig. 19, page 696), but upright instead of leaning at an angle, are soldered on the top to take the wires supporting the shade. A piece like D (Fig. 19) has a thread cut on it to match that on the gas bracket, and is then soldered with the threaded part projecting through the bottom of the reservoir.

The top is now tinned all round the edge on both sides, and soldered on. A file is passed over the edge of the shell to take off the sharpness and get rid of the superfluous solder, after which finish off as usual.

The shade is different to those previously described and figured. It is commonly used for the French reading lamps. Size, six inches across the rim: price, 1s. 6d.

You will notice that its shape permits it to drop right through the gallery. To prevent this, it is necessary to either solder little bits of stout wire inside the rim of it to rest on, or let the supporting wires project through about ½ inch before soldering them.

You will, of course, try the gas bracket, to see if it is at all shaky, but whether the bracket is firm or loose, it is desirable to put as little weight on it as possible. This is one of the reasons why I have figured the lamp as having only half a reservoir, so to speak, and with only a small shade.

As this lamp cannot stand when taken off the bracket for any purpose, such as cleaning, it is necessary to stand it in something—a gallipot, for instance. The gallipot might have a piece of wood with a small hole in the top fixed in it. The hole would receive the projecting screw, and the reservoir would by this means be prevented from turning over sideways.

The next lamp (Fig. 40) is intended to provide light for players of the organ or piano. Most of the American organs are provided with a flat-topped bracket, obviously intended for a lamp; and pianos all have candle sconces, even the cheapest. Perhaps it would be more correct to say "even the best," the rule appearing to be "the worse the piano the better the sconces."

The figure needs very little explanation, being very similar to Fig. 39. You need not cut the edge of the shell off before soldering in the bottom, and the part projecting from the bottom will not be wanted if the lamp is intended to stand on a flat surface; but if it is intended to fit in a sconce, the piece must be added. It is merely a short piece of tapering tube made of the sheet brass, of such a size that it fits tightly into the sconce intended to receive it.

If, as is generally the case, the hole should be too shallow to give the lamps a firm hold, it is better to make the tube parallel, and make it fit over the *outside* of the sconce. It will then be safe enough—unless you happen to be a Rubinstein.

The reflector is principally intended to keep the light off the eyes, and is made of the sheet brass carefully flattened, and then bent round on anything handy—a gallipot, for instance. The hammer must not be used to bend it, or when the light shines on it it will present the appearance of a piece of ancient hammered brass work—all dents. A piece of the ½ in. by $\frac{1}{16}$ in. flat brass wire is soldered on to support the reflector, and a little piece of metal soldered on at M, as shown, to prevent the reflector slipping down too far. Two little strips of metal (thin) are soldered on the reflector to admit the end of the flat wire, the whole arrangement being shown at A in the figure. Polish up as usual, and you can then inaugurate the new lamp with selections from "Aladdin." I do not know if there is a composition of that name. I hope there is, for the sake of the joke.

It may be that you have a dark landing or passage which you wish to illuminate. A simple form of lamp suitable for this purpose is that shown at Fig. 41. It needs very little description, most of the operations connected with it having been treated of in the descriptions of the other lamps. It is intended to be hung on a nail—a brass-headed one preferably—and is fitted with a reflector. Brass is the metal used throughout.

The reservoir is of the shape and may be of the dimensions shown, and three inches high. The top is slightly larger than the bottom, and, in fact, the whole reservoir is an exact copy of the front part of the reading lamp reservoir (Fig. 1, p. 480), to the description of which I must refer you for further directions as to soldering, etc. The piece forming the sides is soldered to the top, and the two are then soldered to the back piece, and the bottom soldered in. The back is nine inches high, and may be of the shape shown. It *must* be wired with stout wire at the edges, unless made of thick plate—a very wasteful proceeding—and have a hole shaped as shown. A piece of the ½ in. by $\frac{1}{16}$ in. flat brass wire is soldered to the back to support the reflector, as shown. The latter is fitted and made exactly like that in Fig. 40, with the exception that the radius is greater. Tilt the reflector forward at the top, so that the light is thrown on the floor, where it is wanted—not in people's eyes.

I have now come to the end of the domestic lamps, and I think I may as well give the shopkeepers a turn, particularly as they seem to be taking so kindly to lamps. I expect they find oil comes cheaper than gas, and they have no heavy gas bill to look forward to—a great consideration with gas burners generally, and especially in the eyes of a struggling shopkeeper.

By far the most common form of lamp used in shops is the hanging lamp, something after the style of Figs. 42 and 43. Another style is the gas-bracket lamp. I will deal with the latter first.

The reservoir is best made like Fig. 39, although, of course, there is no objection to making it like Fig. 40, and I think Fig. 40 looks best. In either case the screw must be soldered in the bottom.

It is not advisable to have glass shades of any size on gas-bracket lamps. Paper or card answers every purpose, and lasts a very long time. Fifteen inches is a good size for the shade. To support it, we shall need an arrangement rather different to that already described. It consists of the common wire skeleton that is seen in shops, with the ends of the wires supporting it secured to the burner.

To make it, proceed as follows: turn the tin or card shade bottom upwards, and make a ring of tinned iron wire ½ in. larger all round than the hole in the top of the shade. Make another ring ½ in. smaller all round than the edge of the shade. Drop both rings into the shade, joining them together by three or four pieces of the wire, and solder three or four pieces of the wire to the largest ring, bent to the shape shown in Fig. 45, to support the shade. Use plenty of solder at the joins, making it run as in Fig. 44, where the black part represents the solder.

Now make a hole in a piece of stout brass plate large enough to permit it to drop over the burner, and fit rather tightly where indicated in Fig. 2 (p. 480) by the arrow. Cut off the superfluous metal all round until a ring is left ½ in. wide. Drill holes equidistant, to admit the ends of the wires supporting the

shade, insert them a little way through, and solder on the under side—the arrangement being shown at Fig. 45. The lamp is now finished, and can be screwed on to the gas bracket.

The hanging lamps of the style previously described appear to me to be too good for a workshop or any rough trade. I therefore give two designs for cheap and simple hanging lamps.

The first one (Fig. 42) is suspended by means of a piece of the flat wire bent as shown, riveted and soldered to the ring previously described. The figure explains how the shade is kept from falling.

If desired, the cost can be still further reduced by making the reservoir entirely yourself of sheet brass, or even tin plate, of the shape shown in Fig. 43. It is made in three parts, two coned pieces having their edges lapped $\frac{1}{8}$ in. over the edge of the central part. The diameter of the latter is $5\frac{1}{2}$ in., and the holes at the small ends of the cones are to be sufficiently large to just admit the screw collar of the burner, which is allowed to project slightly inside, and then soldered.

before riveting, in order to prevent the work twisting. This applies to all parts that are riveted in these two lamps.

It is as well to put a little paper cap over the top of the chimney of *any* lamp while it is not being used. It keeps out dust, and reduces the amount of cleaning necessary.

A filling can (Fig. 46) is almost a necessity. It is made of tin plate, the dimensions being—diameter, 5 in.; height, 6 in. It has a coned top, as shown by the dotted line, the edge of the latter being turned over on to the sides, so as to get a lapped join. A

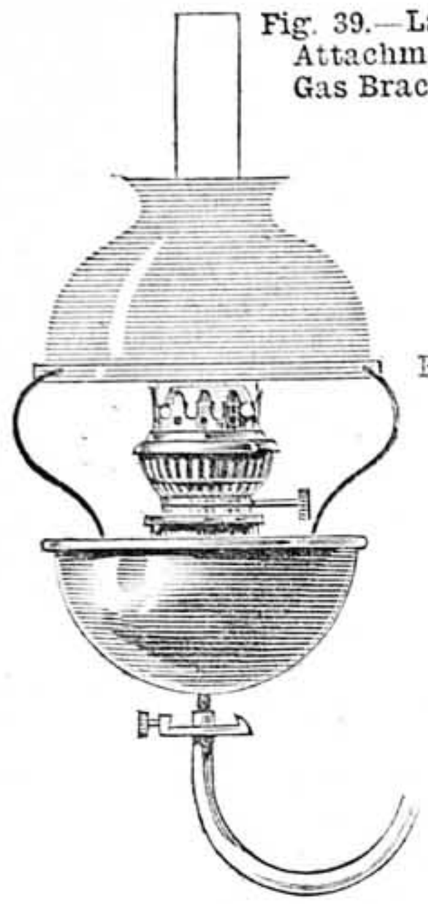


Fig. 39.—Lamp for Attachment to Gas Bracket.

Fig. 38.—Leg for Fig. 33, p. 804 (half size).

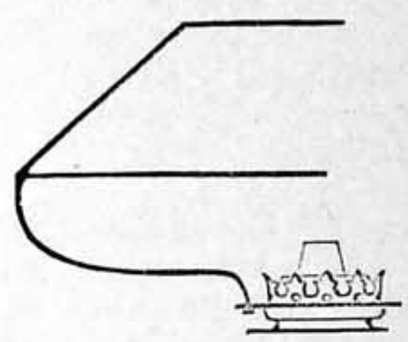


Fig. 45.—Mode of attaching Wire Shade-Holder to Burner.

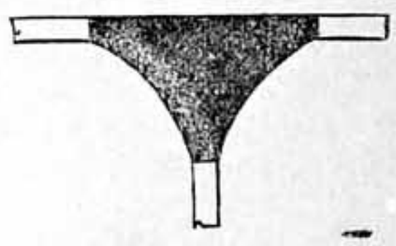


Fig. 44.—Mode of securing Wires for supporting Card Shades.

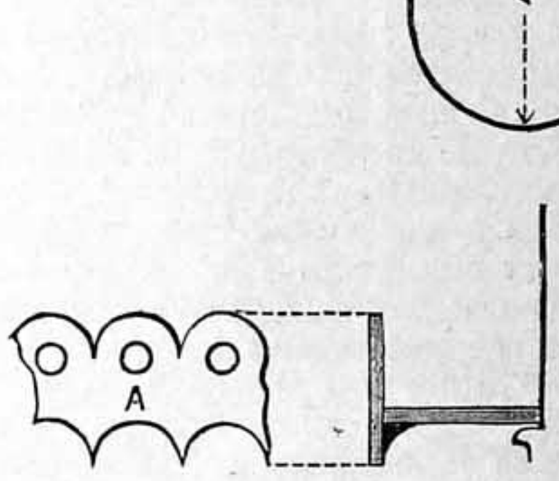



Fig. 37.—Section of Gallery for supporting a Globe—A, Suggested Pattern for Rim.

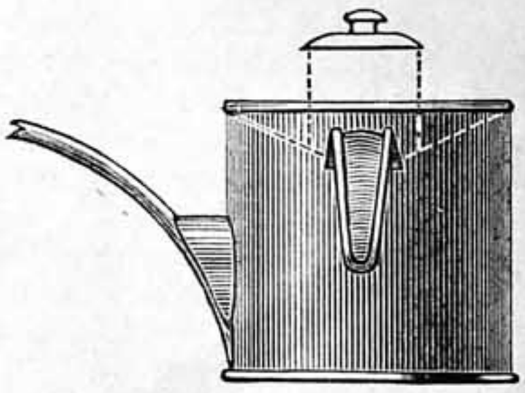


Fig. 46.—Can for filling Lamps.

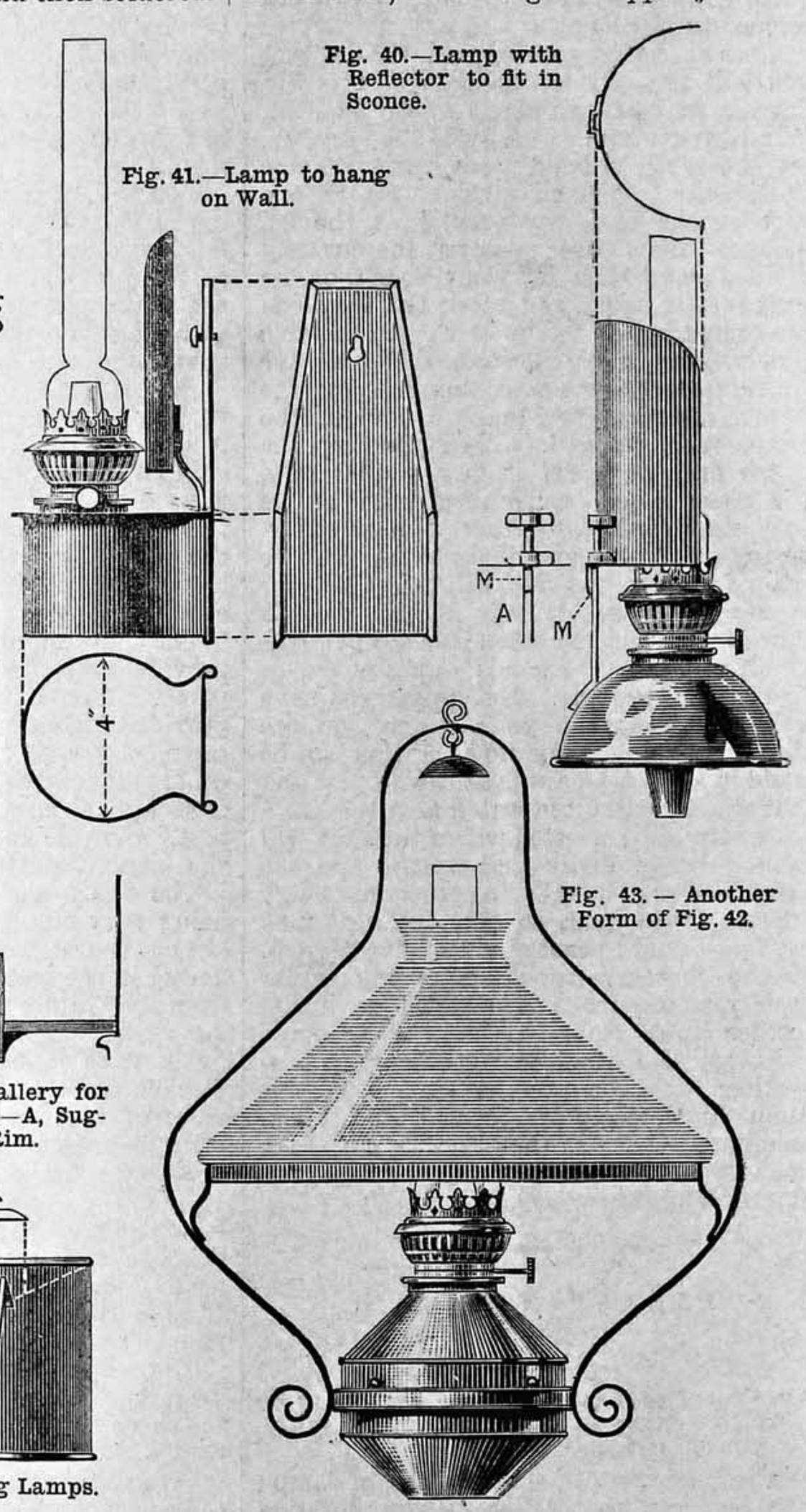



Fig. 40.—Lamp with Reflector to fit in Sconce.

Fig. 41.—Lamp to hang on Wall.

Fig. 43.—Another Form of Fig. 42.

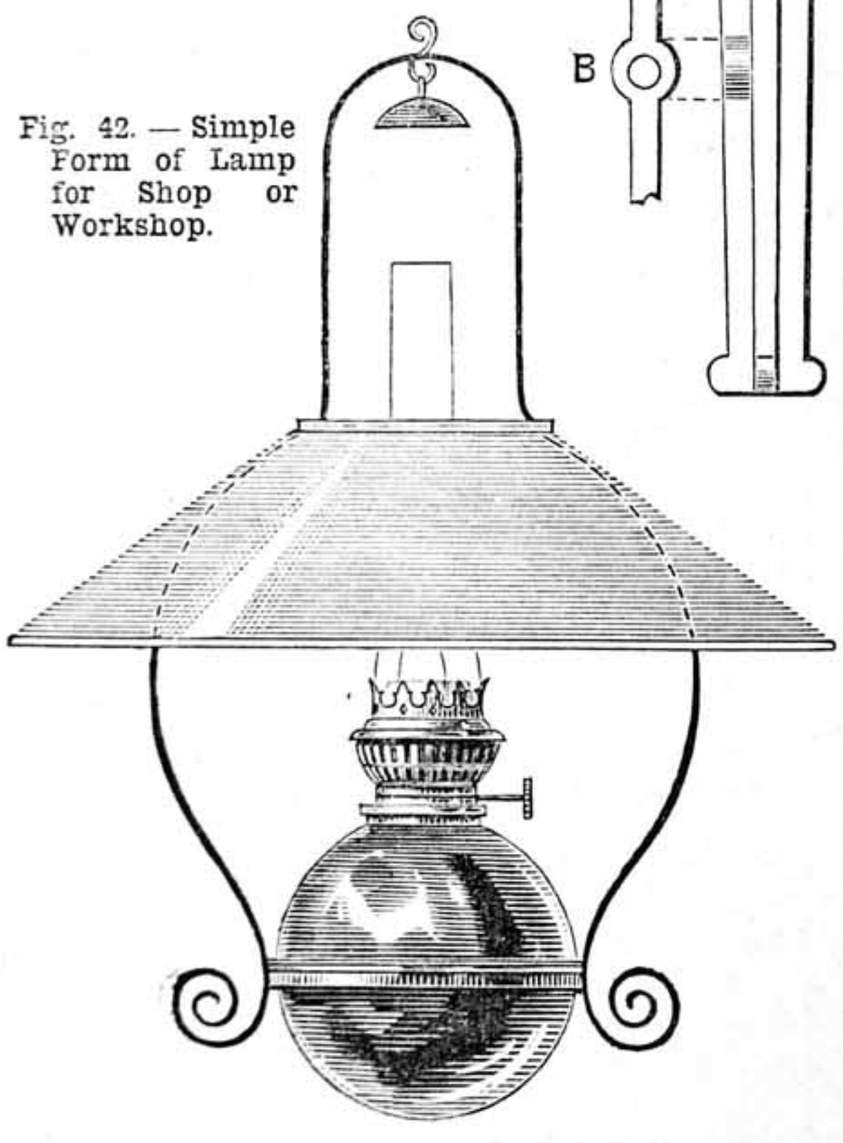


Fig. 42.—Simple Form of Lamp for Shop or Workshop.

supporting the reservoir, which ring can be made of the same thickness wire ($\frac{1}{16}$ in.) in both these lamps, as very little strain comes on it.

To secure uniformity in the opposite sides of the wire, it is necessary to draw the outline of one side on a piece of paper, and then bend the wire to it. The height from the top to the middle of the reservoir may be two feet in both lamps. A hole is made in the top, and an S-shaped hook is inserted by which to hang it up, and the lamp should be further provided with a disc known as a smoke consumer, which must be about six inches from the top of the chimney.

The shade may be of tin, not less than fifteen inches in diameter, and made as

Three or four holes are made in the central part, and rivets put through from the inside, and soldered, with the ends projecting. This prevents the reservoir dropping right through the ring. A circular piece of brass, the size of the hole, is soldered in the cone intended for the bottom, and the two cones are soldered on to the central part, the overlapping edges being first tinned. Clean off the superfluous solder, and polish up.

The gallery for the shade is made of $\frac{1}{8}$ in. by $\frac{1}{2}$ in. flat wire in the way previously described. Wire $\frac{1}{16}$ in. thick would be too thin, and probably result in the gallery getting bent oval in form. Rivet it in place as shown, by means of two little pieces of the $\frac{1}{16}$ in. flat wire, taking the precaution to solder

handle is soldered on, and a spout made of $\frac{1}{4}$ in. brass tubing, strengthened by a piece of tin soldered to it and the body. The handle and the mode of strengthening the spout can be copied from any toilet water-can, except the new-fashioned ones. A lid is made either to work on a hinge or pull in and out like a kettle-lid. A rivet is soldered on to form a handle; or better, a small leaden handle like those on the cheap kettle-lids.

This completes the present series of lamps. I know soldering is not in favour with amateurs, the majority of whom consider it rather *infra dig.*, and call it hard names, such as "tinkering!" But I expect it is a case of sour grapes.

It must, however, be admitted that "tinkering," as they call it, is not one of the pleasantest or lightest of hobbies; but then, it has the great merit of being useful. When you feel tea-time coming round, just think who is the most useful member of society—the man who can stop a leak in the kettle or put a teapot in working order, or the man who can turn out wonderful ivory and hardwood knick-knacks? Verdict for the tinker, of course, on the principle of "Ease before elegance."

In this and the preceding papers on the same subject I have endeavoured, and, I trust, not without success, to unfold the mysteries of lamp-making, and to show any handy man how he may make his own lamps if he be so minded. Such an one, however, must always bear in mind that strong clean soldering is impossible unless the parts are clean and fit. Even a dummy at soldering would probably turn out better work, if he fitted it well, than the professional who had to solder badly-fitting work.

I would therefore, in conclusion, impress on beginners in the art (for it *is* an art) one very useful piece of advice, which ought to be hung up in every amateur's workshop, and *always* kept in mind—

"Above all things, be exact."

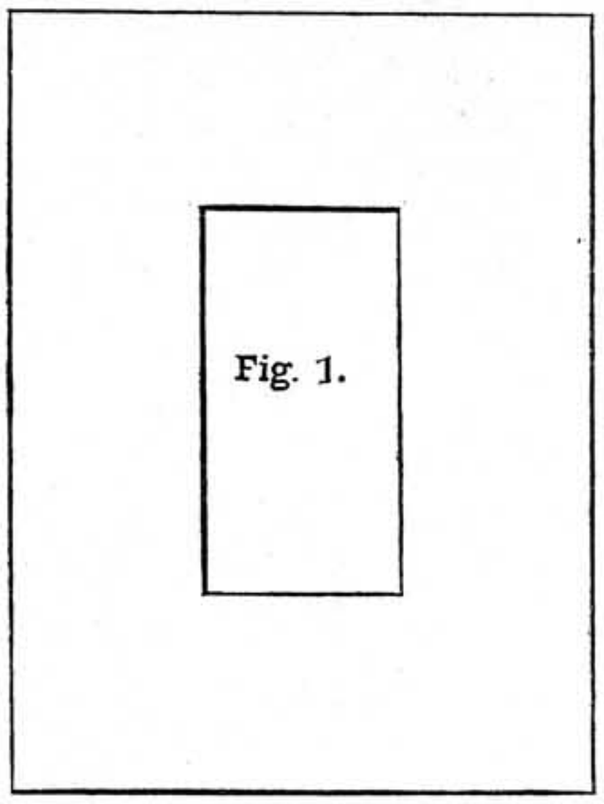
There is nothing that stands on the same level with exactness except punctuality and regularity, and if a man be punctual, regular, and exact in the present day, he stands well ahead of the general ruck of humanity.

## A NEW DECORATIVE MATERIAL.

BY LAWRENCE C. LITTLE, C.E.

Most people are familiar with the bast mats so largely used for packing purposes, by gardeners for protecting trees from frost, etc., etc. The material from which these mats are made—bass, or bast—is the inner bark of the lime or linden-tree. It is also called *liber* (Lat., the inner bark of a tree), and was used, long before the invention of paper, for writing upon—hence the term *liber*, a book or writing. After a process of steeping in water, the layers of bast are easily separated from the outer bark, and, after drying, are manufactured into ropes and lines, into matting, even into a kind of shoes, etc., by the peasants of Russia, whence the great bulk of this matting comes to us, millions of these mats being used by this country alone. In some parts of Europe bast hats are also made, after the manner of straw hats.

Looking about recently for a mount for a drawing, and feeling dissatisfied with the effect of ordinary white, gold, or tinted mounts, I resolved to try some kind of canvas or cloth of coarse texture, when a piece of ordinary bast mat hanging within sight decided me to try the effect of this material as a medium for producing decorative results. The result was highly gratifying, and I propose to show here, very briefly, for the benefit of Work readers, how the material may be applied.




Suppose, then, that a mount of the form in Fig 1 is to be made, 24 in. by 18 in., with opening of, say, 12 in. by 6 in.; cut out a mount in the ordinary way from a piece of stiff millboard or any other suitable material. Stretch lightly and evenly, face down, on a board, a piece of bast matting somewhat larger than the mount; give the back a good equal coating of starch or flour paste, but not so as to go through to the face, and allow to dry, when the loosely plaited matting will be found to be firmly bound together, and capable of being cut or folded without the ends of the strands fraying out. When quite dry, fasten the cut-out mount down on the mat with strong glue, and cut away all the superfluous matting, except about half or three-quarters of an inch (according to the thickness of the mount) all round the edges, both outside and inside, as shown by the dotted lines in Fig. 2; fold the margins so left neatly over on the back of the mount, and fasten down in the same way; lay a flat board with a few weights on the work, and allow it to set. Finally, fix the picture, and cover the back with strong paper or bookbinders' cloth.

If the mount so made is to be protected by glass, nothing further is required, and the effect is very pleasing for many kinds of pictures; but if it is to be without such protection, it is obvious that dust would, in course of time, lodge in the interstices of the matting. To prevent this, a coating of good strong size, made of transparent glue, should be carefully worked over the surface, so as to fill up the spaces between the strands, and make the surface solid, without destroying the effect, and, at the same time, leave it in a condition for varnishing, painting, or gilding. Size made with gelatine and a small proportion of bichromate of potassium will, after exposure to sunlight and air, give a surface which will not be affected by moisture, so that where a "shiny" surface is an objection, no varnishing is required. The bichromate will slightly darken the bast if too much is used. So far as I have yet seen (my attempts have been wholly tentative), the natural tones of the matting, slightly varying with almost every strand, from nearly white to golden brown, are far more artistic than any painting could ever make them, unless done by a person of great taste and experience. To preserve the characteristic texture of the bast, any painting, enamelling, or even gilding, must be very delicate. Staining or dyeing would be suitable for some work, but should be done before the coating of paste is put on.

A good plan, when a mount to put under glass is required, is to make liberal use of fine starch paste (two or three coats), and, when quite dry, simply to cut out the mount from the matting of the exact size with a sharp knife, without folding over the edges. Broad mounts are always more effective than narrow ones.

Even waste cuttings of the matting can be very artistically arranged to produce effective mounts and frames, as will be readily understood from the rough sketches, Figs. 3, 4, and 5; and the *modus operandi*

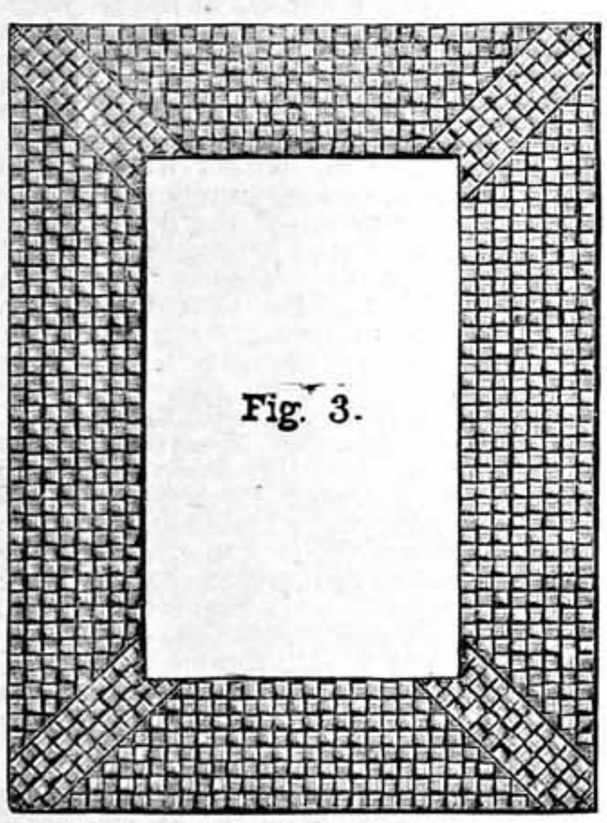



Fig. 3.—Square Bast Mat Mount.

Fig. 1.—Cardboard cut for Mount.

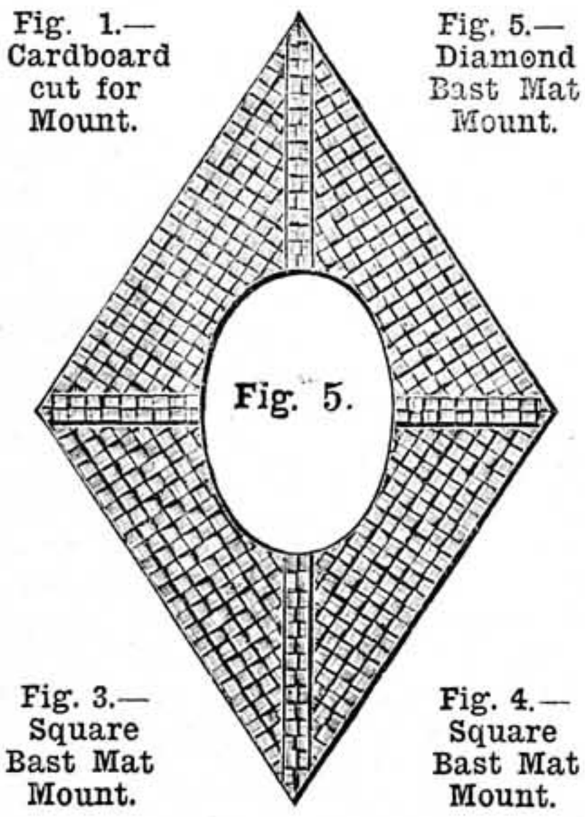



Fig. 5.—Diamond Bast Mat Mount.

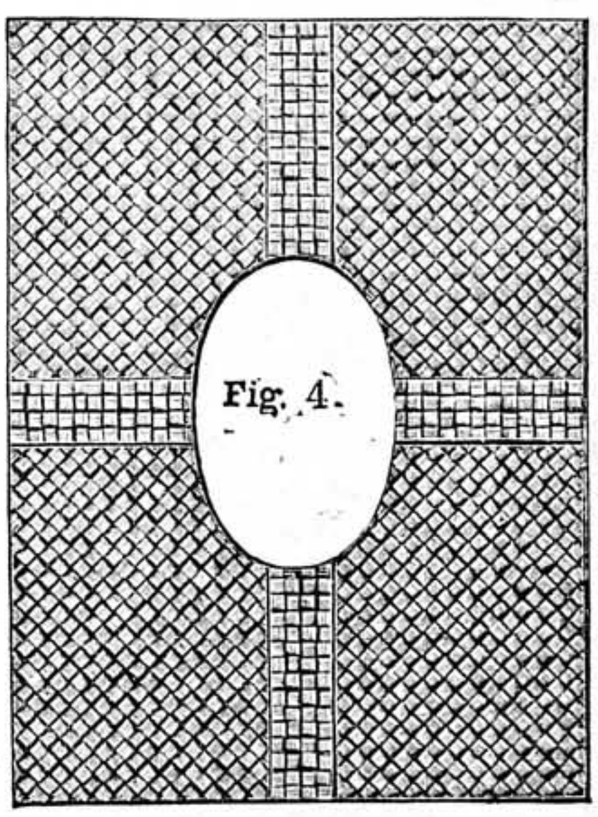



Fig. 4.—Square Bast Mat Mount.

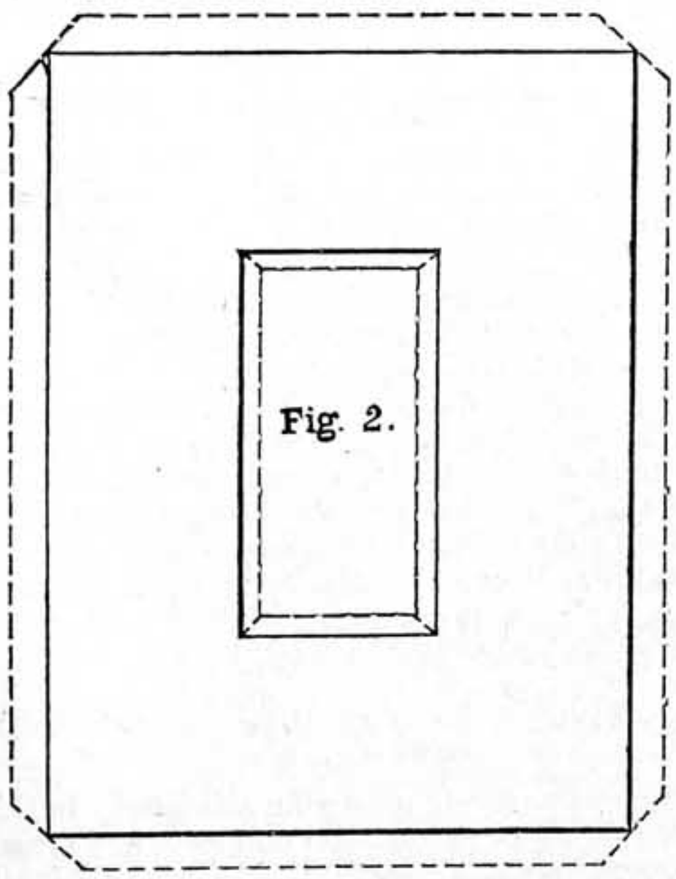



**Fig. 2.—Cardboard Mount as in Fig. 1, with Overlay of Bast Mat cut for covering it.**

is so very simple, and the material so cheap, that anyone, with care, may successfully undertake the work. The bast should, of course, be quite clean, and free from sharp creases. If any objection should arise from the peculiar smell of the bast, it may easily be removed by incorporating with the paste a little carbolic acid, oil of rosemary, or some such substance, but after exposure to the air for a short time I do not think even this will be necessary.

Picture frames and mounts only have been dealt with here, but it will be evident to readers that bast matting can, with advantage, be applied as a decorative material to many other purposes, such as draught and fire-screens, boxes, wall brackets, etc., etc. Other kinds of matting, such as "tea" mats, which are woven with smaller and more equal strands, would make very pretty mounts; but the very irregularities, both of size and colour, of the common bast mats constitute the great charm of the work when finished.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 130.—Model Electro-Motor, Siemens Type.

Amateurs who are interested in electricity and all that pertains to it will be glad to know that Mr. H. Atkinson, 137, Stamford Road, Handsworth, Birmingham, is now supplying model electro-motors of the bridged Siemens type. Each motor is constructed in the most effective manner with soft malleable iron field magnets and armature and gun-metal fittings. The brushes are held on an adjustable rocker by adjustable brush holders. The little machine sent as a specimen is nicely got up and mounted on a polished oak base 10 in. in length by 8 in. in breadth. The gun-metal fittings are polished bright. The exposed iron is japanned black, and the wire coils coated with red sealing-wax varnish. This little motor will work a small sewing machine, fret machine, or dental lathe, when driven with a current from a battery of some three or four-quart size chromic acid cells. The price of the machine, complete, is £2 2s. Any amateur wishing to try his hand at making one of these can have a full set of castings for 3s. 6d., and wire to wind them for another 2s. The castings are very clean, and are in themselves good value for the money asked for them. So desirable and useful does this machine appear to be, that Mr. George Edwinson Bonney has undertaken to write a paper on its general construction and the fitting of the castings in putting them together, which will shortly appear in the pages of Work.

### 131.—Hints on Wood-Carving.

"Hints on Wood-Carving, Recreative Classes, and Modelling for Beginners," to give this book its full title, is a most useful and exhaustive work on the subject, written by Miss Eleanor Rowe, the accomplished manager of the School of Art Wood-Carving, City and Guilds Technical Institute, Exhibition Road, Kensington, S.W., and published with the sanction of the Committee of the School of Art Wood-Carving, where it may be obtained for 1s., or of Messrs. Sutton, Drowley and Co., 11, Ludgate Hill, London, E.C. Coming from the source from which it emanates, it bears the impress of authority, and imparts information reliable in itself, and therefore valuable, thoroughly practical, and sufficient in every respect for the requirements of the learner. The preface is written by Mr. J. H. Pollen, a member of the Committee of Management, who bears ample testimony to the skill and proficiency of Miss Rowe as a wood-carver and as a teacher of the art. The book shows the system of training followed at the School of Art Wood-Carving, and treats of the implements required, the selection of wood, the methods of grounding, the formation of recreative artisan classes, stains and varnishes, the taking of casts from work in the wood, and modelling as applied to wood-carving. The illustrations are most effective, many of them exhibiting what may be termed fac-simile reproductions of wood-carving so faithfully rendered that it would be almost impossible to fail in imitating them successfully in wood.

### 132.—Original Designs for Repoussé.

This is the second series of Original Designs for Repoussé issued by Mr. T. J. Gawthorp, 16, Long Acre, London, W.C., at 1s. I trust I have not fallen into error in giving his initials, for I notice that this able craftsman in all kinds of metal work invariably subscribes his designs in true baronial style with "Gawthorp" only, as if to intimate that he is *the* Gawthorp, as he really is; and, that being so, he ought to share the privilege attaching to Sir John Monckton, the Town Clerk of the City of London, of signing all civic proclamations with his surname only. I strongly recommend all repoussé-workers, and wood-carvers too, to invest a shilling in this book of designs, for while every pattern that is given therein is well suited for the purposes of the former, there are many that the latter may utilise as designs for wood-carving, far more attractive in their quaintness of form than the stereotyped scroll-work and flowing foliage of the Renaissance period, of which it is possible to get tired by reason of their endless repetition and reproduction. For example, the centre for an alms basin exhibiting the emblems of the four Evangelists might well be turned to good account for carving in wood, with many others of the designs which would readily lend themselves for adaptation for this purpose. Taken through and throughout, the book is a good shilling's-worth, and is further useful for bearing on the back of the wrapper a list of materials, tools, etc., required for repoussé-work, with prices, and Mr. Gawthorp's terms for lessons in this fascinating art-work, which deserves to be taken up by amateurs far more enthusiastically than it seems to be.

### 133.—"The Photographic Reporter."

This is a handsome monthly magazine, devoted to the advancement of photography, edited by Mr. Charles W. Hastings, editor of *The Amateur Photographer*, *Photographic Quarterly*, etc., and printed and published at 1s. by Messrs. Hazell, Watson & Viney, Limited, 1, Creed Lane, Ludgate Hill, London, E.C. It will be interesting to photographers generally for its papers, its summary of society's meetings, its Directory of Photographic Societies, and the notices of the Monthly Photographic Competitions held under the auspices of *The Amateur Photographer*. Several excellent reproductions of good photos of persons, places, and things will be found in the part which bears date January, 1891.

### 134.—Taylor's Shilling Book of New Fretwork Designs.

There is certainly plenty for the money in this book of designs, printed and published at Taylor's Fretwork Manufactory, 18, Melbourne Street, Blackpool, at 1s., as the title declares. I cannot say much for the originality and beauty of the designs, which seem to lack in quality the inducements which abundantly exist in quantity. Some of the designs are easy for beginners, but more than this it is not possible for me to say. Simplicity in design is one thing, and poverty of conception in form is altogether another. Young fretworkers should always select patterns which, however simple they may be, are likely to look attractive when cut.

THE EDITOR.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Fire-Lighting Apparatus.**—J. M. (*Manchester*) writes:—"To reconcile H. G. (*Dewsbury*), in No. 99 of WORK, to accept the sound advice of C. C. C., the fire-lighting apparatus he describes was introduced to the public some twenty-five years ago; *but it didn't 'go.'* Why, I cannot tell, but surmise the trouble and expense of keeping the indiarubber pipe free and tight would be the nuisance, as gas exercises a solvent action on rubber, especially common or inferior qualities."

**Domestic Gas Governor.**—Mr. John Mangnall (*Harpurhey, Manchester*) writes:—"I thank you for the liberal notice of the gas governor designed by me in No. 98, but as you remark that you cannot see how it can effect the purpose except in design, perhaps a few more supplemental remarks on gas governors may be generally useful, if it is not trespassing too much upon your space to the exclusion of others. As you remark, there is nothing so satisfactory as a practical test, and if you desire to acquaint me with the most acceptable size—viz., for ½ in. or ¾ in. supply pipe—I shall be glad to forward you one of the domestic gas governors; and if it corrects the erratic nature of your gas bills, as humorously described in a past number of WORK, I shall share the pleasure with you. All gas regulators or governors are of one of two types. First—Regulators, of which the 'Carnaby' is the premier type, and merely control the supply of gas to the meter from the main top at will; they consist of a communication from some convenient place by means of flexible cords or wire to the main supply cock, whereby the supply can be regulated from absolute 'cut off' to anything between it and absolute 'full on;' they are usually furnished with a dial, pointer, and key, so that the degree of change may be noted. This type is very popular with houses of public entertainment, where a full supply is frequently required to be altered to just a few lights, the dial above referred to generally being marked with the corresponding number of lights the supply is regulated to. As may be already inferred, this type regulates the gas *before* it enters the meter. The second type differs from the above in being automatic in action, by regulating the pressure at which the gas is allowed to flow through the supply pipes, as already asserted. Gas companies are compelled to supply gas at higher pressure than it is economical to burn it, and as the velocity of flow through the supply pipes is directly in proportion to the square roots of the pressures, more gas is frequently driven through the burners than can be economically used. It is generally accepted that the most economical pressure to burn gas at, *for illuminating purposes*, is from $\frac{8}{10}$ to $\frac{9}{10}$ of an inch water column; some even prefer the pressure as low as ½ in., or technically called $\frac{5}{10}$, and to reduce the ever fluctuating higher supply pressures to the desired constant lower pressure is the special function of the gas governor proper. These contrivances, and they are very numerous, all act upon *one* principle—viz., the employment of the supply pressure to operate upon a throttle valve, which reduces the volume of the supply for consumption proportionate to the main pressure by a ratio equal to the diminished volume held by the gas under pressure. This type of governor may be divided into two species. First—Those that receive the main supply pressure in a bell receiver, trapped hydraulically as a gas holder, the liquid used being water in those constructed of unusually large dimensions for gas works to supply the mains, and mercury in those for business and private establishments, who are consumers. The second species is simply a diaphragm to receive initially the main supply pressure; the motion of the bell in the first species and that of the diaphragm in the second actuating the throttle valve, and thus regulating the supply for consumption in both cases. Hitherto, the second species have relied upon some membranous substance—such as leather, bladder, etc.—from which to construct the diaphragm, which absorbing moisture was liable in cold weather to become frozen, and, as a matter of sequence, inoperative; and as this occurred altogether in those months when gas was most used for illumination, they naturally fell into disfavour. The *sole merit* of the domestic gas governor designed by me, and the subject of your notice, is that the diaphragm is constructed of metal in the form of a corrugated disc, and, as a matter of course, not materially affected by changes of temperature; it also enables it to be produced at an exceptionally low price, as the whole carcase can

be built of sheet metal with soldered joints, as is the case with gas meters."—[What I said was this: "I do not gather that it exists except in design"—that is to say, that as no specimen accompanied your letter, I could only suppose that you were writing in reference to the principle only, and not on an invention which was actually in the market. I wish to see specimens of articles to be noticed whenever the expense of sending them for inspection is not too great; and it is always desirable that price, etc., should be mentioned. Anyone wishing to adopt the domestic gas governor now has it in his power to communicate with you direct.—ED.]

**Errata.**—G. E. B. (*Lewisham*) writes:—"On page 757, Vol. II. of WORK, will be found an illustration (Fig. 59) showing how to wind the field-magnet cores of a Manchester dynamo. In this, the right-hand core is shown with the coil of wire coming to the front, and passing to the right of the core. If wound in this way, the machine would not work. The coil should be wound around this core in the opposite direction—viz., from right to left, so as to give a north polarity to the lower arch and a south polarity to the upper arch."

## II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Cleaning Lawn-Tennis Balls.**—F. R. (*Sutton Coldfield*).—Lawn-tennis balls may be cleaned by brushing them with a hard, dry nail-brush. They must first be thoroughly dried, but not in too warm a place. Ayres sells a circular machine-brush for the purpose, but it is not so effective as the hand-brushing, although the latter takes both time and patience.—C. T. S.

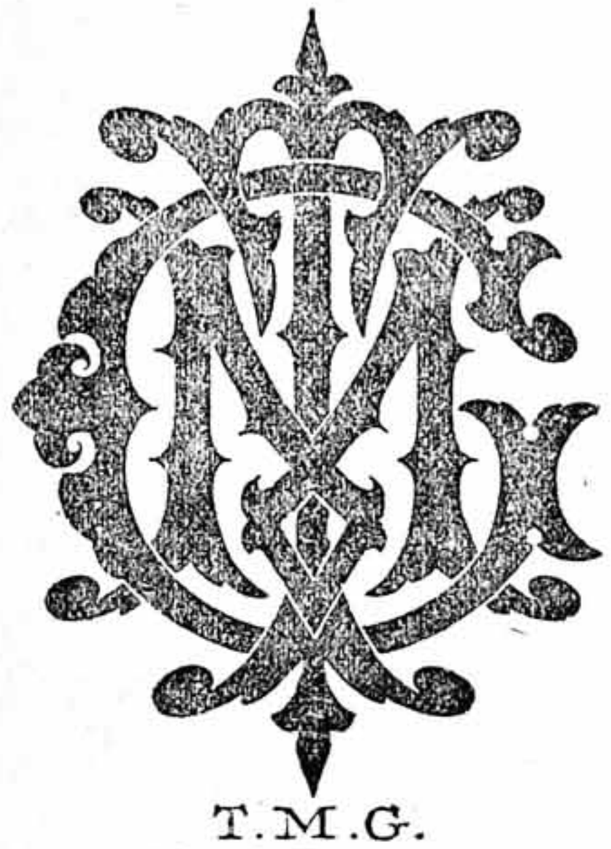
**Restoring Drawings.**—J. M. (*Middlesbrough*).—The sepia drawing to which you refer will require treating by an expert; no amateur should attempt to handle it if it be valuable; if not, it is scarcely worth the trouble. The most dependable restorer I can refer you to is Wm. Grisbrook, 6, Panton Street, Haymarket, London, S.W. If you write to him, you may mention WORK. For instructions in picture-frame making, you cannot do better than write for the little book on that subject, published by George Rees, 41, Russell Street, Covent Garden, W.C. It is issued at about 1s. Mr. Rees also supplies all materials required, such as tools, mouldings, backboard stuff, mount boards, etc.—F. B.

**Tubing and Lenses.**—T. T. (*Northampton*) writes as follows:—"Will O. B. kindly give information to T. T. in 'Shop' as to length of tubing, diameter and focus of lenses, distance apart of each lens for making telescope of twenty miles' range, and also best place to procure brass tubing and lenses." Now I call that a sensible letter—one can just see exactly what the writer wants, at any rate. Sometimes letters come to hand, and it is almost impossible to understand what is required. I would just say here that shortly I purpose placing in the Editor's hands articles dealing with the whole question of telescopes and stands. The questions submitted by T. T. are brief and pointed, but involve too much to be compressed in "Shop"—at least, I fear the Editor would think so. I will, however, answer briefly. O. G., 2 in. diameter, and, say, 30 in. focus; body tube, 20 in. long by 2¼ in. internal diameter. Eyepiece, say, field lens, 1 in.; focus eye lens, ½ in.; separating focus, ¾ in.; this to fit into a sliding tube for focussing. This certainly would be a telescope of twenty miles' range. But what does T. T. want to see at that distance—a fly brushing its wings or a full-rigged ship? "Twenty miles' range" is a mysterious phrase used by *shopticians*. When I want optical materials, I generally apply to Mr. Lancaster, Colemore Row, Birmingham; he always serves me well, but there are other places in abundance where the lenses may be obtained. I believe Mr. L. also supplies tubing. I have got some from Messrs. Staunton, 21, Shoe Lane, Fleet Street, London. I would further add that the Editor has in hand a short article on Eyepieces, which will no doubt appear at some future date, and which will give T. T. and others all information as to the construction of eyepieces of various focus. That being so; it is not advisable to discuss the question at length here. I shall be glad to answer any other question if able.—O. B.

**Cleaning Lacquered Brass Ornaments.**—C. W. G. (*Belfast*).—If you examine your vase, you will most likely find that the three supports you mention are screwed on. I should advise that you take these off, and as you say they are plated, I should clean them separately with a plate brush and some good plate powder (Stephenson's is an excellent one). Then as to the lacquered parts, I am afraid that if they are much tarnished, you will have to relacquer them, or have them done by a brass-finisher. You can, however, try washing them with warm, not hot, soap and water; this may freshen them up a good bit. Then rinse off with plain warm water, and let it dry of itself. If you decide to relacquer it and require advice, write again.—R. A.

**Imitating Inlay.**—ST. PETER'S BOY.—Do you want to imitate inlay on a design or coloured drawing of a rosewood cabinet? If so, no coloured ink could be used with the slightest hope of success. After having coloured the drawing to your idea of rosewood, paint the representation of inlay with body colour. If the drawing is only a small one, it is hopeless to expect that you will be able to get in anything like all the detail. It ought to be sufficient just to indicate the character of the inlay; so that if you want a working design of this, your best plan will be to draw it separately.—D. A.

**Monogram for Fretwork.**—T. M. G. (*Crewkerne*).—You ask for a design for your monogram to cut in fretwork. Here it is, and it is hoped that by transposing or shading, the same combination of letters will be found useful to others whose names may combine the capitals T. M. G.—A. C.



T.M.G.

Fretwork Monogram.

**Play Box.**—DITTONIAN.—Not knowing the size of your chess-men and draughts, nor how many sets you wish to accommodate, I cannot give you fuller details for a play box than I am about to do. You will see by Fig. 1 that the front can be turned to account as a marking board. To permit it to lay quite flat, the front edge of the bottom board and bottom edge of the front board should be canted and hinged, as shown by Fig. 2, in which diagram A represents the front board. For the card compartment, I should say, make it a little less in depth than the width of the cards, and have the latter laying on the slope as in Fig. 1. You might insert a small board, on the slope, at the back of the compartment, as a guide and support for the cards. My reason for advising the cards to be thus placed,

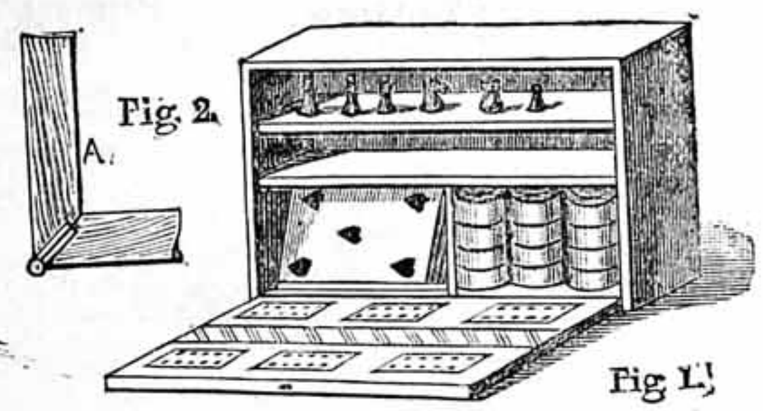



**Fig. 1.—Box Open. Fig. 2.—How to hinge Front (Marking Board) to Bottom Board, in order that it may lay quite flat.**

is because, if laying quite flat, the top compartments would be wider than I show them, and being so narrow in depth, their contents would not be easily obtainable; and if standing quite perpendicular they would always be liable to tumbling out. To prevent them from slipping from the position in which they now stand, fix a narrow strip of wood along the bottom of the front of the compartment. Have the latter a trifle longer than the cards, to allow for the insertion of a finger to extricate them. Dovetail outside boards together, and if nailing or screwing the remainder is not considered sufficiently strong, read "Lessons from an Old Bureau" (Fig. 20) in No 20 of WORK, Vol. I., page 309. Fasten with a hook, bolt, or lock.—J. S.

**Tiles.**—F. H. (*London, S.E.*).—You could not do better than try Harrison & Spooner, of Cannon Street, E.C., who deal very largely in the above.—E. D.

**Architect's Price Book.**—JACK.—I have no doubt the book you want is Laxton's "Architect and Builder's Price-Book," published by Kelly and Co., 51, Great Queen Street, Lincoln's Inn Fields, London, W.C. I think the price is about 4s. nett.—E. D.

**Wood Buying.**—JAMES.—You can get complete sets of any kind of furniture ready for upholstering and polishing from the wholesale firms in Worship Street, City Road, and Curtain Road, E.C., or from Maple & Co., Tottenham Court Road. In reply to your other inquiry, *re* selling log timber: if not otherwise stated, it is understood by the foot super.—A. J. H.

**Timber Merchants.**—A. P. (*London, S.E.*).—The nearest firm to you where you can get American walnut is "Ware's," Kennington Lane, S.E.; or if you are in the City, take a walk up City Road, and there are plenty of merchants who keep all kinds of fretwork cut in all sizes for use. The price for ½ in. American walnut is about 6d. per ft.—A. J. H.

**Cylinder Float.**—WATER.—A body to float in water must displace its own weight of such water. As water weighs 62½ lbs. per cubic foot, the capacity of any vessel to support a given weight, including its own, is easily found. For example, you want to support 112 lbs. by a float; we will suppose this includes the weight of float; 112 divided by 62½ gives 1·8 (1⅘) cubic feet as the quantity of water to be displaced. The capacity of the cylinder float is equal to its cross-sectional area multiplied by its length. The area is 0·7854 multiplied by the square of the diameter, and the proportion you take (6 in. by 3 in.) makes the length two diameters. If then $d$ = the diameter, the cubic capacity of the cylinder will be $= 0{\cdot}7854d^3 \times 2d = 1{\cdot}57d^3 = 1{\cdot}8$ cubic feet, therefore $d = \sqrt[3]{\frac{1{\cdot}8}{1{\cdot}57}} = 1{\cdot}0466 = 1$ ft., 0 $\frac{5}{16}$ in. diameter. The length will be twice this—that is, 2 ft. 1¼ in. There is no necessity to keep to these proportions, and having found the total capacity necessary, if you divide by the length of float you get the sectional area, and *vice versâ*. You must understand that in taking the weight to be supported you must include *the weight of the float itself*. Your float 6 in. long by 3 in. diameter will support a total weight (including its own) of 1 lb. 8½ oz. The float should be made slightly larger than the calculated size to overcome friction in rising through the water; the allowance to be made will depend upon the speed at which you want it to rise. This resistance varies as the square of the speed of movement.—F. C.

**Walnut Overmantel.**—F. S. C. (*Durham*).—I can hardly advise you to run the risk of spoiling the appearance of your overmantel by trying to make inlaid panels. As you have never done any inlaying, you would probably make a mess of it, unless you confined yourself to a very bold plain design. I would rather suggest fretwork, as you can manage it. Cut the fret in thin stuff, and lay it on a solid foundation. This, you no doubt know, is a method often practised—it is both simple and effective. The narrow panel might be covered with plush or Japanese leather-paper. The job would look much better if you had left out the rail between the two narrow panels above the centre shelf, or if you had fastened the shelf to it, and left out the rail to which the shelf is now fastened. For patterns of turning, look up back numbers of WORK, and adapt any piece of turning which may take your fancy to the sizes you require. Shoulder the shelves up to the squares of the columns, instead of putting columns between the shelves. For price of glass, why not have applied to one or other of the firms whose names have been mentioned in WORK, or to a really good cabinet-maker? There is no fixed price for glass, as there is for WORK or any similar magazine, and without inquiring we cannot tell what a particular firm will charge. Prices may vary 50 per cent., according to quality, etc. Width of bevel is a matter of taste—¾ in. or 1 in. would do very well. Please not to write to members of the staff of WORK by name, but to the Editor. Replies cannot be sent privately by post, those given in "Shop" being published *pro bono publico*.—D. D.

**Rubber Stamps.**—LUX ET VERITAS.—Full instructions for making rubber stamps are given in articles on pages 594 and 630, Nos. 38 and 40, Vol. I. of WORK. Materials and apparatus, including type, can be obtained from M. Lindner, 170, Fleet Street, London, E.C.; H. Savage, 33, Cheapside, London, E.C.; or from J. G. New, Parade Iron Works, Birmingham. A small outfit can be obtained from G. Smith, Park Row, Leeds; but this is scarcely more than a toy, although good work can be produced by its aid.—QUI VIVE.

**Rubber Stamps.**—JOHN SMITH (*Jedburgh*).—See reply to LUX ET VERITAS, above.—QUI VIVE.

**Window Cornice, etc.**—JOINT.—You must give a good many more particulars than you have done before I could give you any definite directions how to make your cornice. At present, all you tell amounts to this—that you have bought something to make a cornice of, and you want information on the whole subject of cornice making. To do this would only take up a few pages of "Shop," but even this space cannot be spared, so write more fully. Your communication is an admirable specimen of those vague inquiries which do not give a peg to hang an answer on. I, too, have seen a book which has something in it about turning potatoes into something like ivory, and my recollection of the process is such that I do not think you need waste valuable time in hunting it up.—D. D.

**Blue Prints.**—S. S. (*Erith*).—Prepare two solutions, A and B. A consists of fifteen drachms of ammonio-citrate of iron dissolved in eight ounces of water. B solution consists of ten drachms of ferricyanide of potassium in eight ounces of water. Mix the two solutions in equal quantities, and apply the mixture rapidly to paper by means of a sponge or a camel-hair softener mounted in quill, and dry in the dark. A grain of potassium bichromate added to every two ounces of the mixed solution will make the paper keep. After printing, wash well in plain cold water.—D.

**Fan Mounting.**—A. H. W. (*London, W.*).—Mdme. Ida, 7, Prince's Street, Regent Street, London, W. (entrance in Castle Street), intends taking up fan mounting. She has only lately commenced business on her own account, so the fan mounting may not be started yet. A. H. W. could inquire there. Also of Mrs. Heitland, Amberly Art Studios, Crouch Hill, N.—C.

**Shocks from Dynamo Machines.**—S. S. G. (*Walworth*).—There cannot be any shock to a person handling a dynamo giving a direct current of a low voltage. Neither can a person receive a shock by merely touching the machine with one hand, providing, of course, that no other part of his body is in circuit with the machine being touched. The law relating to induction coils also governs the current from dynamos of all types and sizes; there can be no shock from them unless your body forms a link in the circuit, or two portions of the body form a branch circuit. It is unsafe to meddle with large dynamos, or with any part of an electric light circuit in a large installation, even to touching it with one hand only, unless you are thoroughly acquainted with it, because of the uncertainty of knowing when the mere act of touching may complete the circuit, as you may be standing on one conductor of the circuit or on something in connection with it. The newspaper reports of accidents are nearly always inaccurate, because they omit unobserved details.—G. E. B.

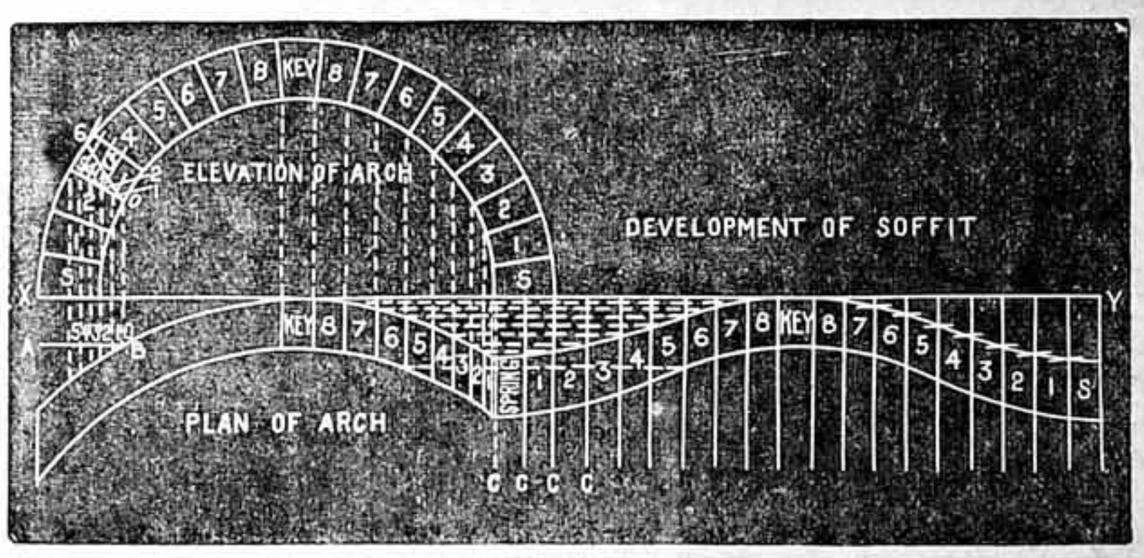
**Castings of Dynamos.**—READER (*Belfast*).—Castings of all the dynamos described in WORK, in the series of articles on "Model Electric Lights," can be supplied by Mr. S. Bottone, Wallington, Surrey. The Gramme dynamo castings can also be supplied by Mr. A. Crofts, Dover, Kent. Both of these gentlemen supply books giving full instructions on making and using the machines. The books cost from 2s. 6d. to 3s. each. You will find full instructions in the articles on this subject running through Vol. II. of WORK. By consulting the tables given in those articles, you will see that the larger sizes of dynamos are run at lower speeds than the smaller sizes. The quantity of wire got on the armature has much to do with the speed required for a given output, and this must necessarily be small in a small machine, because the armature is too small to admit a large quantity of wire. Try Ormiston & Co., 25 and 27 Old Street, London, E.C., for a small quantity of zinc wire.—G. E. B.

**Power for Dynamo.**—H. J. H. (*Homerton*).—(1) The power required to drive a dynamo of any type is governed by the output in electric current of the dynamo being driven. Thus, if you require a light of 50 c.p., you must have a dynamo capable of giving an output of at least 175 watts of electric energy, since we must reckon for 3½ watts to each c.p. As it takes 1 h.p. to furnish 746 watts of electric energy, your 50 c.p. of electric light will absorb about ¼ h.p. The efficiency of the machine will depend more upon the material and workmanship than the type. (2) The cheapest motor is a water-wheel, driven by a natural fall of water. Next to this may be classed a steam engine. To town dwellers the first is impossible, and small water motors are not admissible on all water mains. Steam engines on a small scale may be used, but require much attention. Gas engines may be used, as I have already shown. The cost at 1d. per hour, which would be about the cost for gas, would amount to 4s. 2d. per week of fifty hours.—G. E. B.

**Electrotype Copies of Leaves.**—E. R. (*Melbourne*).—Copies of leaves, fruit, fish, and reptiles must be first taken in plaster. Embed half of the subject in sand, put a paper rim all around to circumscribe the mould, mix plaster of Paris to the consistency of cream, and cover the subject wholly with the mixture. When the plaster has set, remove the subject carefully, and dry the mould gently; then bake hard in an oven. Coat the mould with linseed-oil, and bake again; repeat this until the plaster has been rendered non-absorbent. The inside of the mould must be coated with best blacklead, applied with a soft brush. This coat must be connected to guiding wires, and suspended in the electrotyping solution, exposed to a constant current of electricity for several hours, until the shell of copper has attained the required thickness. If both sides of the subject are to be copied, two moulds must be made, and the two shells of copper soldered together when finished. "Electrotyping," by J. W. Urquhart, and "Electro-Deposition," by A. Watt, are two useful books on the subject; both published by Crosby Lockwood & Co., London.—G. E. B.

**Electrical Experiments.**—J. S. (*Huddersfield*).—Some very interesting experiments can be performed with an ordinary horse-shoe magnet bought at a toy shop. Iron filings may be mixed with those of other metals, and taken out again by the magnet. A packet of mixed pins may be explored in a similar manner for the detection of iron pins. Mixed tinned brads and tacks may be assorted. Iron filings spread on a piece of cardboard, and gently struck with a straw whilst the magnet is held beneath, will arrange themselves around the poles of the magnet, and show the lines of magnetic force. Iron brads embedded in small cork boats, floating on a glass of water, may be directed with the magnet held above or at the side. With a battery and a small electro-magnet the range of experiments can be further extended. By adding an induction coil, a still larger range of experiments can be opened up. Some of these with vacuum tubes are very beautiful. A number of experiments are illustrated in "Intensity Coils, how Made and Used," by Dyer, price 1s. I hope you will succeed in alluring the lads from the pernicious influence of street corner conferences.—G. E. B.

**Circle on Circle Templates.**—W. O. (*Wrexham*).—For the moulds you want, first draw the elevation and plan of arch, and divide the elevation into the necessary number of parts, working from the soffit, or under side of arch; this gives the joints of bricks in elevation. From these joints drop perpendiculars to intersect plan, and this will give the plan of joints on soffit line. Next set off along the line, X Y, the same number and sizes of bricks as there are on the elevation on the soffit line, and from these points drop perpendiculars, c, c, etc., starting from the inside of right-hand springing brick. Take each distance from X Y on plan both inside and outside arch, and working from X Y, cut the perpendiculars, c, c, etc., one after the other, as sketch. (I have only shown the joints in half of plan, but as the other side is exactly the same, it is unnecessary.) If you now draw from point to point through these perpendiculars, you will have the soffit mould of bricks. A good tip for understanding this is to cut the development of soffit out of paper and hinge it on the right-hand springing line on plan, and bend it over until the right-hand springing line of development coincides with the left-hand springing line of plan. If you look down on this paper arch, you will at once see that it exactly stands over the plan. You next want the face or bed mould, and must bear in mind that the face of each brick on one half of the arch is different; the sweep of the springing bricks being equal to the curve of the wall, and becoming flatter as they approach towards an upright position. You must also note that the mould gives the *joint*, or bed—that is to say, the top of one brick and the bottom of the next. This is very important, so that a separate mould must be got for each joint, with which you mark the top of one brick and the bottom of the next. We will now suppose we want to get the mould for the joint between bricks 2 and 3; the mould will answer for both sides of the arch in the corresponding course by turning it over. Divide the joint 2, 3 into any number of equal parts, and drop perpendiculars to touch plan in 0, 1, 2, 3, 4, 5. Draw A B parallel with springing line, X Y; next draw lines square with joint 2, 3, and set off on these lines the same distances that 0, 1, 2, 3, 4, 5 are from plan of arch, measuring from A B, and draw through these points the curve 0, 6, and this will give the face or joint mould for bricks 2 and 3. I may say that this sort of arch is generally cut directly into its place and rubbed down after it is set, without any moulds except a rough centre, unless it is very large or in very good work.—E. D.




Arch Plan.

**Piano Making.**—I. A. (*Wheatley, Halifax*).—Your question as to whether you would be able to make a piano depends more on yourself for an answer than for anyone to tell you—for this reason, that it is impossible for me to tell your age, whether you fully understand the subject as far as you have read it, and whether you have a taste for mechanical work. I may say, there are several amateurs making pianos from the instructions given in WORK. I can only say, Try. And to try, in most cases means success. The cost to make varies according to your facilities for obtaining material. In London the material would cost about £8. Of course, London is the home of the piano-making industry.—T. E.

**Piano Action.**—W. J. C. (*New Hampton*).—Your best plan will be to weight the front of the key; or, if there is too much lead in the back of the key, you could remove some, and try a few keys. To weight the front, proceed as follows:—Get a ⅜ in. centre-bit, and bore a hole in a piece of hard wood ½ in. thick; now procure some old lead from a plumber's, and melt it in a ladle. Lay the wood in which you have bored the hole on a flat-iron, and pour the lead in. When this is cold, knock it out of the wood. This forms your weight. Now take your action out of the piano, and place this weight on the front of the key, moving it towards the back until the key is on the balance; then move a shade back, so that the back of the key just returns to its rest. When you have found the desired place, make a mark with a pencil; serve all the keys in the same way, then bore at the marks and fill with lead.—T. E.

**Polo Indicator.**—N. F. M. (*Paddington*).—(1) The pole indicator inquired for is made in Germany, but I do not know how it is made. Sir D. Salomons supposes it to be filled with a solution of iodine in glycerine, which turns purple at the negative pole when a current of electricity is sent through the instrument. (2) Platinum can be obtained from Messrs. Johnson & Matthey, dealers in precious metals, Hatton Garden, London, E.C. (3) I cannot say which is the *cheapest* house in London for the supply of laminated iron punchings. (4) Write to the Secretary of the Institution of Electrical Engineers, 4, The Sanctuary, Westminster, S.W.—G. E. B.

**Electric Lighting.**—CORBEX.—I cannot hold out any immediate hope of a *cheap* private installation of electric light. If you find the price of gaslight high, you will experience a still higher cost in attempting to light your shop and house with the electric light. At the outset you will require at least nine incandescent lamps of 16 c.p. each lamp, or eighteen lamps of 8 c.p.; these will cost, with holders, about 6s. each. The dynamo to supply the lamps with current will cost £10, and an engine to drive this will cost from £60 to £70 more. The cost of brackets for the lamps, wires for the lines, switches, and other things, together with labour for fixing, etc., will not leave much out of £100 for plant. An installation worked by battery power would be a costly and intolerable nuisance. My articles on "Model Electric Lights" commenced in the number of WORK published on August 30th. They are continued in the numbers for October 11th, November 29th, and December 20th, 1890; and January 3rd and 24th, 1891. You will learn the cost of battery lighting from the first three articles.—G. E. B.

**Solenoid.**—J. G. (*Nottingham*).—Get a tube of ebonite 1½ in. in length, with a bore 1 in. in diameter; thickness of sides, ⅛ in. Chase a screw thread on each end and screw these into two flanges of thin brass, ⅛ in. thick and 3 in. in diameter. The bottom flange may be larger than this, and have holes drilled in the edge to receive screws for holding down the bobbin to a wood base. Wind this with 2 lbs. of No. 20 cotton-covered copper wire, well insulated by soaking in melted paraffin wax. Leave out at least 6 in. of the commencing end to connect to a binding screw, and have the same length at the other end for the same purpose. See that the inside of the ebonite tube is quite smooth; then loosely fit into it a plunger of 1 in. soft iron, as shown in your sketch. This must be always in the tube at least ¼ in. when the supporting lever is at rest. The pull will be 1¼ in.—that is, to the bottom of the tube. To work this, you should use at least six Fuller cells of ½ gallon size, and you may arrange them as shown in your sketch, but in this case it will be advisable to have the six cells to form the outer battery, for you will not get much power from the inner battery of two cells. Of course, I have not the least idea why you want them arranged in this manner. The wire leading from the batteries to the solenoid must be of No. 18 copper, and at no part of the circuit may there be a smaller gauge of wire employed. If you have a longer length than ten yards of this, you must add another cell to the battery to overcome the extra resistance. It will be advisable to have the switch placed in a position horizontal to the connecting rod, so that the descending cam may press down the end of a lever, the other end of which is wide, and resting on a wide block of brass, say, ¼ in. square, to ensure good contact. One wire should be connected to this block, and the other to the pivot of the switch. The cam must be arranged to break contact at the right moment.—G. E. B.

**Musical Box Comb.**—J. O. (*Huddersfield*).—If your musical box is a fairly good one and worth the trouble and expense, you can procure a comb for 30s. by addressing the maker, stating *number*, also number of tunes, and the new tunes you require; then there will be the cost of carriage from Switzerland, or, if a German make, from Germany. If the comb is such a wreck as to require a new one, the barrel will not have many pins in perfect order upon it.—J. S.

**"C" Spring Balance.**—CARADOC.—You can procure all the makes of "balance springs" (hair-springs you mean, I suppose) at Morris Cohen's Watch Material Store, Leeds. You may require a *weighing machine* spring; if so, as a watchmaker, it is not in my line.—J. S.

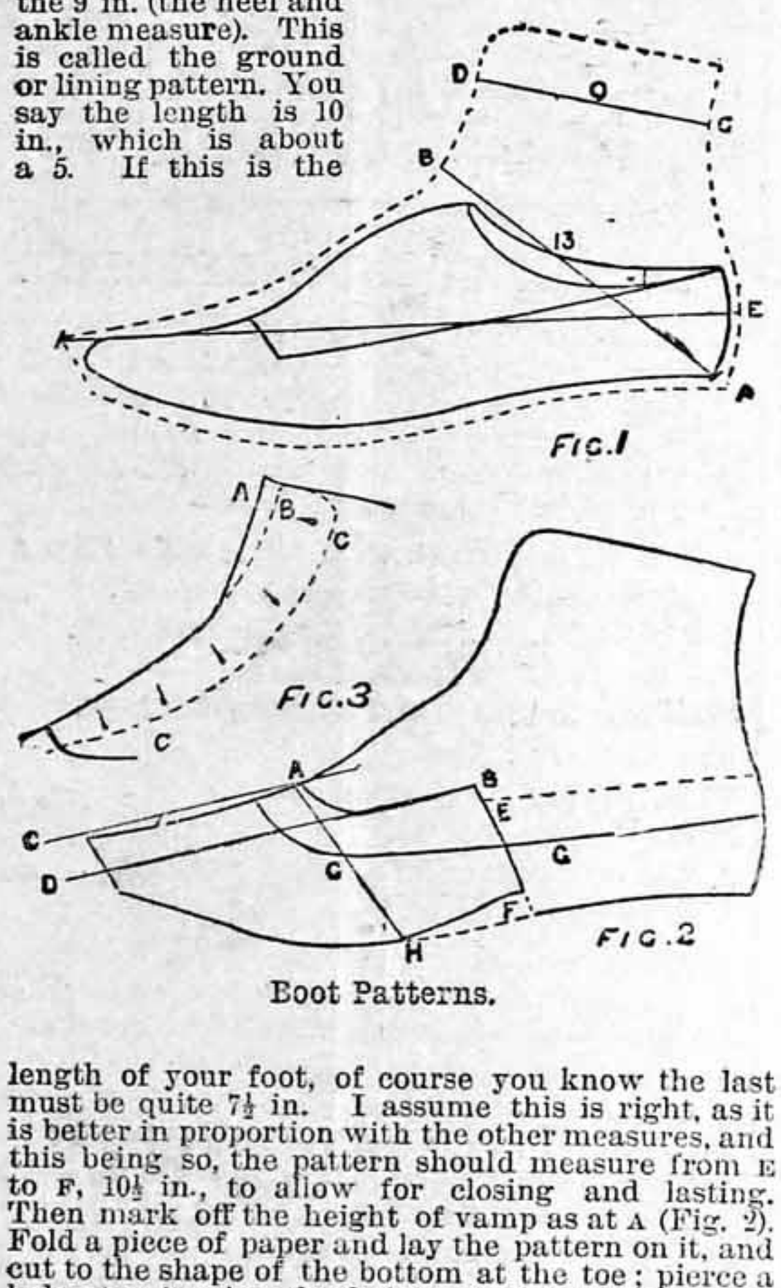
**Varnishing Frames.**—J. B. (*Bradford*).—You cannot prevent oak darkening. Of course, if you use a dark varnish, your frames will look darker than if you use a colourless one. Any good varnish will do, but many people consider that oak frames look best "in the white." You can then scrape or bleach them with a solution of oxalic acid in water whenever they become too dark for your taste.—D. D.

**Dry Plate.**—NO NAME (*Stoke Newington*).—There is no book published especially on this subject. In the first volume of WORK you will find a series of articles on making a camera, illustrated with working drawings, which should be exactly adapted to your requirements.—E. D.

**Screen.**—T. B. (*Ashington*).—It seems probable that Japanese paper would suit your purpose very well, but tastes differ so much that no one but yourself can say positively. The material is quite suitable. Do not use both paper and cretonne in combination, unless you are tolerably familiar with the work. Either used alone will look well. As there are so many different patterns and colourings of Japanese paper, how is it possible, without knowing which you have decided on, to advise you on the choice of a cretonne?—D. D.

**Clock Making.**—NORTHERNER.—These articles will appear at the earliest opportunity.

**Boot Patterns.**—POOR SNOB seems under the impression that the tops have to be cut under the measure at the ball and instep, but really these two points have very little to do with the cutting of the tops, so long as they are left large enough. The measure at the joint or ball is very large in proportion to the length, therefore I should conclude you want them easy, but this has to be done in fitting up the last. To cut a pattern, place a sheet of paper on the cutting board, and place your last upon it, as shown in Fig. 1, in which the dotted lines show how to rough the pattern out. Then measure up to given measure, which is from A to B 6½ in., just half your 13 in., and from C to D, half the 9 in. (the heel and ankle measure). This is called the ground or lining pattern. You say the length is 10 in., which is about a 5. If this is the




Boot Patterns.

length of your foot, of course you know the last must be quite 7½ in. I assume this is right, as it is better in proportion with the other measures, and this being so, the pattern should measure from E to F, 10½ in., to allow for closing and lasting. Then mark off the height of vamp as at A (Fig. 2). Fold a piece of paper and lay the pattern on it, and cut to the shape of the bottom at the toe; pierce a hole at A to give the height, and from this mark cut out as from A to B. If you draw a parallel line, D B to A C, and cut out the centre of the vamp from A to B, you will find (when you draw the wing down till the point B reaches E, level with the golish, and cut off the surplus F) that this gives a spring or draft in the vamp; then cut the golish pattern. This can be cut with or without a seam at the back, where it should not be more than 2¼ in. high. The facings can be cut true to the pattern; but if button, the fly must have a spring in it, so that it will grip to the under quarter; the dotted lines in Fig. 3 show about how much straighter the fly should be to give this spring, the line A being the quarter, and the point B, when stitched to A, gives a grip to the whole of the outer edge, C C. The leg can be cut from the lining pattern by folding it up under vamp and golish, as G G. Toecap can be cut height and shape to fancy. If you have any fear of the pattern being too large or too small at the joint and instep, you can for joint measure—say it is 10½ in.—width of bottom 3½ in., and as you want ¼ in. each side to sew in, it only leaves 3 in.; this 3 in. from the 10½ in. leaves 7½ in., and half 7½ in. is 3¾ in., so A to H should measure 3¾ in., and the instep can be treated in a like manner.—W. G.

**Lamp.**—LANCASHIRE LAD.—Your lamp is called a "Moderator"; it is of French make. It is a lamp that has gone much out of use since the introduction of paraffin and lamps burning that oil. The proper oil to burn in these lamps is best French colza, and it costs about 6d. per pint. These lamps are on the Argand principle of circular wick and central draught, and for whiteness and purity of light and steadiness in burning they have never been beaten. They are still much used in gentlemen's houses of the old school, but the servants who understand using them and the workmen who can repair them *properly* are getting few and far between. Herewith I give instructions which will probably be of service to many a country jobbing hand who may have been puzzled by these lamps. In the first place, if it has not been used for some time it will require taking to pieces and cleaning; this will necessitate the bottom being taken off, and the spring, leather, etc., taken out. To do this, proceed as follows:—Wind the rack up an inch or two, and fix it in that position. I use a wire key (see W, Fig. 2), which slips on the round burner tube and through the wing-key, thus preventing it running down. The reason for doing this is twofold: firstly, because there is a leather plunger or piston that would be spoilt by the heat of the soldering iron in unsoldering the bottom; and secondly, if the rack was not held when the bottom was unsoldered, the pressure of the very stiff spiral spring that forces the piston down would send piston, rack, and dirty oil all over the place, possibly into the face of the operator, which I have seen happen more than once. Having unsoldered the bottom and taken it off, pour out the dirty oil, hold the lamp firmly on the table or bench (in its ordinary position), and gently let the rack down till it leaves the pinion, and the interior can then be taken out. The annexed sketches (Figs. 1 and 2) will render the foregoing and following remark clear. Fig. 1 is a view of the inside of the bottom part, or body, and Fig. 2 of the top part or burner; O is the outer case, of china or brass; I, inner case of tin. The spring, S, reaches from top of inner case to bottom, circles the rack, R, and the oil tube, T, pressing the cup leather, B, B, to which the rack is fastened, and *through* which the oil tube passes. The action of the lamp is as follows:—Pour down the neck of the lamp sufficient oil to nearly fill it, and commence winding up the rack: this draws up the piston and exhausts the air in the lower part of the vessel; the oil in the top then forces down the sides of the piston and takes its place; the piston is then above the oil, and pressing on it; the oil cannot flow back the way it came owing to the shape of the piston, so it takes another course, and flows up the tube, T, which slides into another tube on the

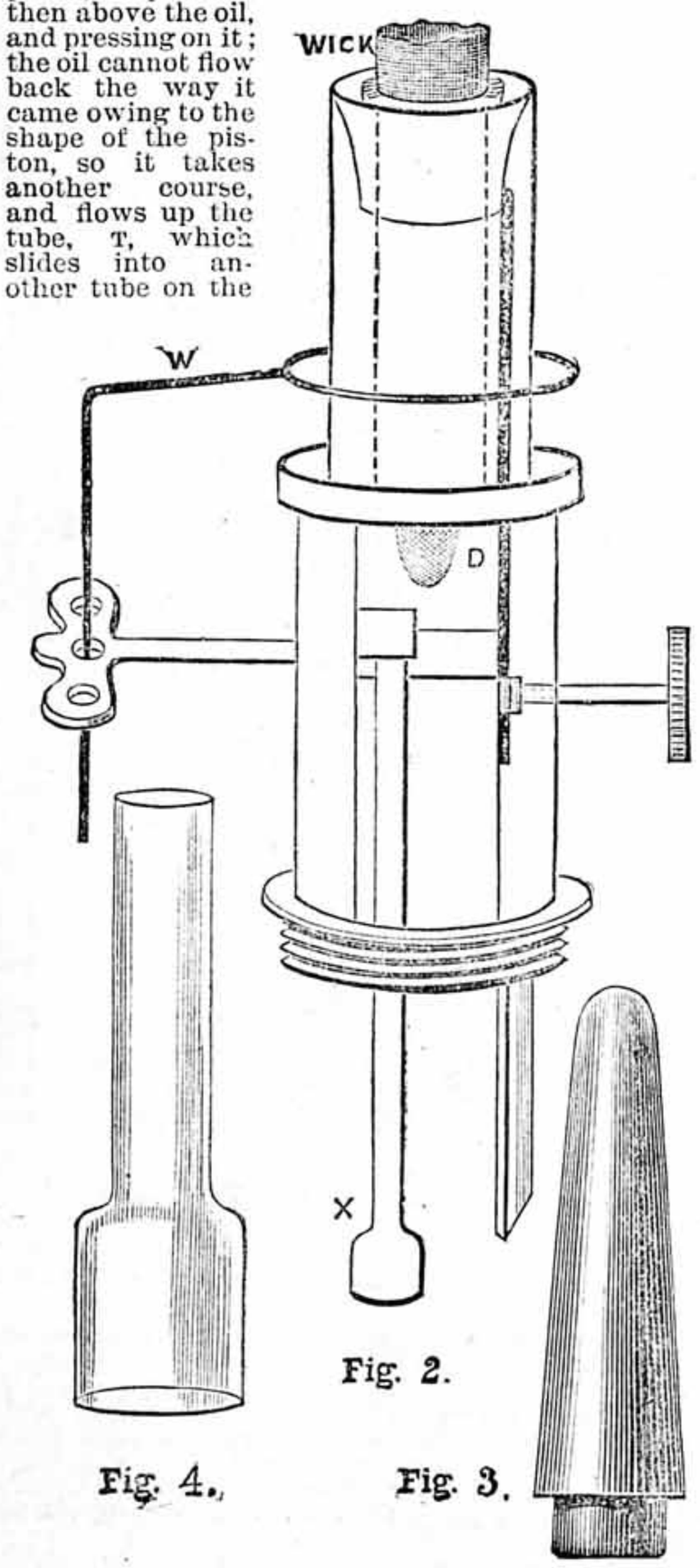



Fig. 2.



Fig. 4.



Fig. 3.

Moderator Lamp Parts. Fig. 2.—Burner of Moderator Lamp (with Key). Fig. 3.—Mandrel for slipping on Wicks. Fig. 4.—Moderator Chimney.

burner (Fig. 2) at X, through which it rises to the wick. As the flow of oil through these tubes would be far too rapid for the flame to consume it, a wire, A (Fig. 1), is inserted in the tube to regulate the flow; it is from this wire that the lamp takes its name, as it is called the "Regulator" or "Moderator," as by it the flow of oil can be regulated or moderated to a nicety: how, I will describe presently. Having cleaned the inside, and also the spring, rack, and tube, and worked the edges of the leather to render it soft, clean the burner part, especially the tube through which the oil flows. This, when blown through from the end X, should let air pass quite freely and with a hissing sound; if it blows hard, work a warm wire up it and flow turps through, with occasional blowing to assist it till it is satisfactory; this is the principal part, and where stoppages mostly occur. Next put together in order as it was taken apart, keeping the rack wound partly up whilst the bottom is soldered in. This done, and the top slipped on and secured, the lamp is ready to be tried; fill with oil, and wind up gently till a gurgling noise is heard, which indicates that the piston is above the oil. Previous to doing this, however, a wick must be put in if there is not one already there. These wicks are circular and of different sizes, known as 6, 8, 10, 12, 14, and 16 line; they are slipped on to a tin ring which is soldered to the small rack in Fig. 2. Three claws, which open as the wick-holder comes above the top, hold the wick in its place; it is slipped on by means of a circular piece of wood called a mandrel, without which it is a job to get them on. After the lamp is wound up, oil should begin to flow in about seven or eight minutes from the top of the burner; it runs over and into a circular channel, and through the spout D, and drops into the body of the lamp again. Now as to regulating. The acme of perfection would, of course, be when the flow was so adjusted that the flame consumed all the oil brought to it, but this is never attained. The best way then is to get a little margin on the right side, and this is found when

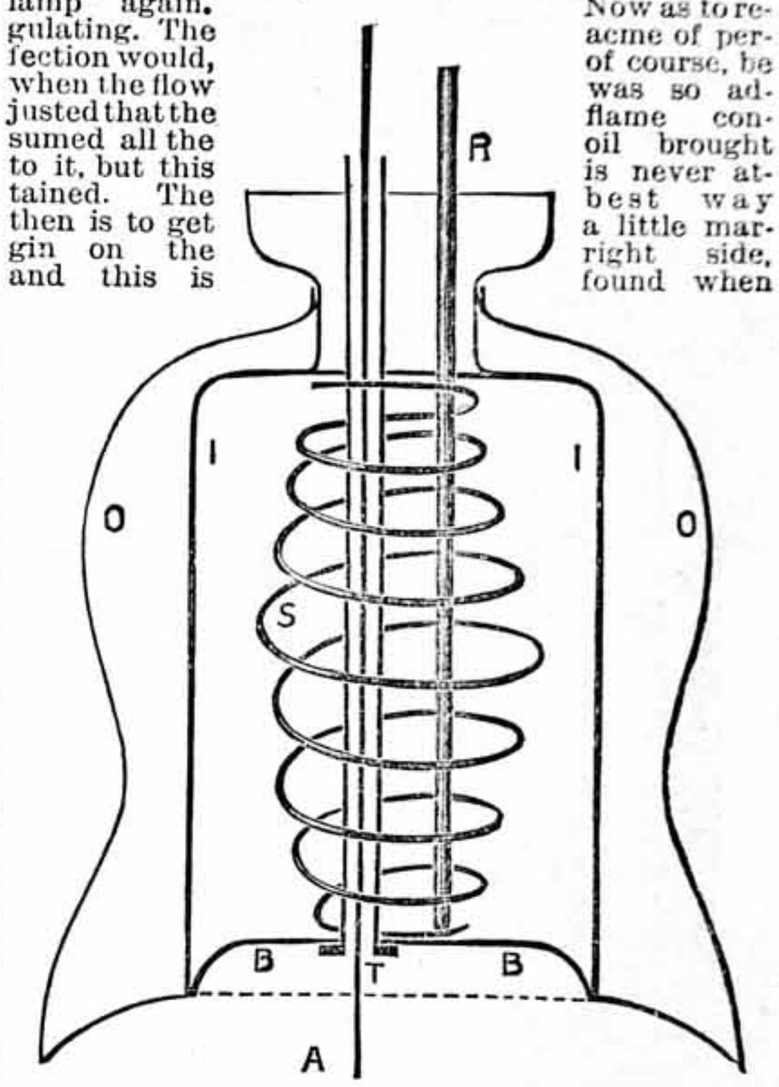



Fig. 1.—Section of Moderator Lamp Body.

the lamp whilst burning drops one drop from the spout in about ten seconds. Thus, when the lamp has burnt for five hours and has run down, by winding it again there is enough oil for it to burn for about half an hour. Should the lamp drip very fast whilst burning, it shows that the regulator is too small; to remedy, tin it with a soldering iron, or put one in a shade larger. If not enough flows through it to support combustion, the regulator must be taken out and filed a little. N.B.—This can be taken out from the top, after unscrewing the burner. Fig. 4 shows the shape of the chimney.—R. A.

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Joiners' Bits.**—B. A. B. (*Hampstead*) writes, in reply to A. A. W. (*Leicester*) (see page 734, Vol. II.):—"Joiners use many boring bits, and it may be at once confessed that many of the various kinds are so similar that our fellow reader may well ask, why such variety? Instead of giving a list, in order to save space I shall describe each, with its use and its most suitable application, beginning with the simplest. Such remarks as I shall make are founded on a long experience. First, the pin-bit: this is very like a gouge sharpened both inside and outside. As sold by the tool-dealers, it is sharpened only outside and obliquely, but I find that sharpened inside just a little and both the corners removed, so that the contact with the wood takes place in the centre of the gouge-like end of the bit, its cutting is improved, while smoothing and polishing all over tends to allow the chips to escape more freely: a condition which has to be obeyed in the planning of every cutting-tool. This bit is only suitable for boring at right angles to the fibre of the wood, the sharp gouge-like edge cutting freely, but in a hole of any depth the chips still have a tendency to remain; it is, however, an excellent bit if you want to bore right through. For boring top and bottom laths for Venetian blinds, etc., and boring pins to hold tenons in their mortices (from which it derives the name of pin-bit), it is first-rate—further, it is cheap. There is also a bit used by chair-makers similar to a cheese-taster; the stem is like the pin-bit, but the cutting edge is like a hollow hemisphere. This I have never used, but I have often seen work done by its aid; its advantage seems to be the improved power to withdraw the core, the rounded bottom to the cylindrical hole, and its suitability for chair and brush-making; it is not suitable for boring right through. The spoon-bit also resembles the pin-bit, but it has some attempt at a point—in outline something like a tea-spoon, but more like the outline of a Gothic window, the outline being hollowed out to form a cutting edge. This bit will bore easily, freely, and well; it will enter more exactly where the worker wishes, is quite easy with the before-mentioned, and sharpened nicely, is a most useful bit; it is strong and cheap, and is used by pianoforte makers for wrest-pins, etc., chiefly, no doubt, because it can be reduced easily to fit the pins required, and within reasonable limits it is

improved by such reduction. The nose-bit is another of similar construction, the stem like all the preceding. Its cutting edge, from which it derives its name, is like a part of the steel bent nearly to a right angle, and sharpened so that it forms a sort of chisel. To avoid catching, the corners are sharpened off. For boring across the grain it is most wayward, generally entering half its diameter away from where you intended, and it is not a useful bit to buy unless you want to bore the end-way of the grain: then the nose-bit is in its right place, efficient, and cheap. Like the preceding, it must be withdrawn now and then to remove the chips, or it gets choked. There is also another bit of somewhat similar character, which in many ways is superior to any of the foregoing. It is called half-twist or diamond on the tool-maker's list; it literally screws itself into the wood, and the chips tend to the surface. It would not do to bore holes in narrow strips of wood, but for every other purpose: it is good for boring holes in either hard or soft wood any way of the grain. It is, I believe, of Norwegian origin. There is also a bit exactly like a gimlet used largely by coffin-makers, and certainly it serves well in elm and oak, but beyond

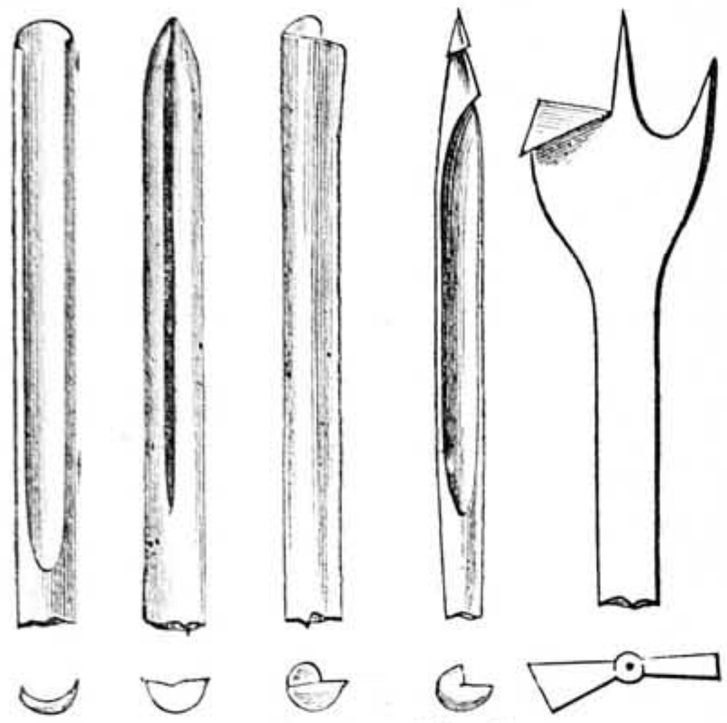


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

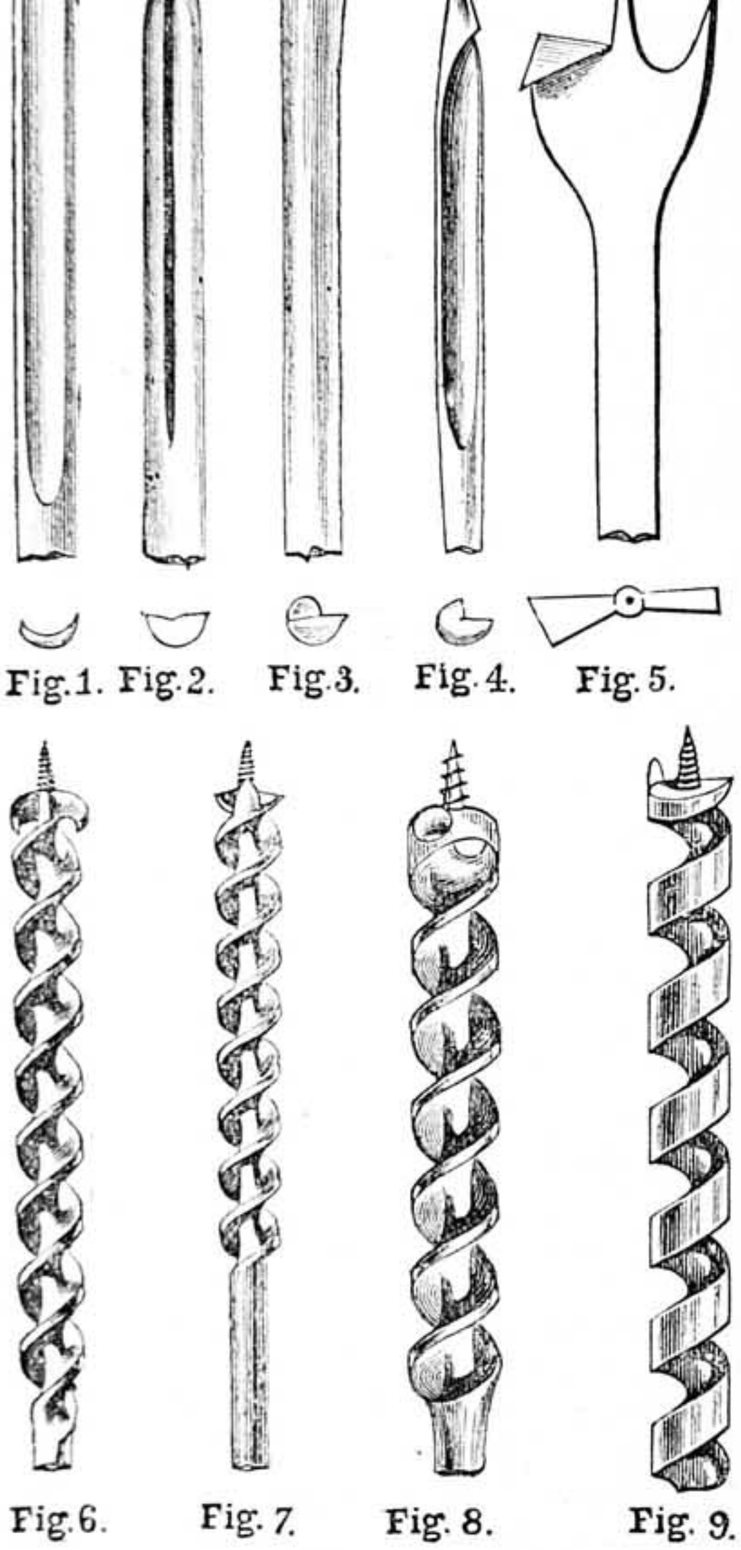


Fig. 6. Fig. 7. Fig. 8. Fig. 9.

Boring-Bits. Fig. 1.—Pin-Bit. Fig. 2.—Spoon-Bit. Fig. 3.—Nose-Bit. Fig. 4.—Half Twist or Diamond. Fig. 5.—Centre-Bit. Fig. 6.—Gedge's Bit. Fig. 7.—Jennings's Bit. Fig. 8.—Whitehouse's Patent. Fig. 9.—Mathieson's Single Twist.

that it has no special feature to recommend it. This completes the list of what may be roughly called quill-bits or pin-bits: they vary from quite small bits to about ⅝ in. diameter, rarely even being made as large. They can all be obtained in a great variety of sizes, but no exact size is guaranteed, the usual plan being to bore a hole and measure it rather than to measure the bit. Centre-bits are the next: they are generally useful for boring holes larger than pin bits, and they are much superior in the important point of boring just where the hole is required; hence for fixing locks some small centre-bits are useful for key-holes, although the before-mentioned are generally the most useful for holes up to about ½ in. The centre-bit consists of a piece of steel so shaped as to fulfil these three requirements—a centre, a circle-cutter, and a chisel to remove the core of the hole, and must be so formed as to act in the order named. A great bore in buying centre-bits is that the hole by no means agrees with the size of the bit. You want to bore a ½ in. hole; you send for a ½ in. bit, and you are annoyed to find that it bores at least ⅝ in. There is, however, a remedy now, for a patent expanding centre-bit has been introduced, which I have tried, and it works well, and though the price is high, yet its purchase, instead of a multitude of centre-bits, will save money. I bought a 1 in. bit; result, 1⅛ in. hole, extending to 2½ in., price 3s. This extending centre-bit is the very thing for organ-builders. The patent twisted bits having a screw-centre are first-class, the only thing against them being the expense; they bore well in any wood and in any direction, relieving themselves of the chips and cutting true to dimension. Most of the patents have now expired. Mathieson's, Gedge's, and Jennings's are excellent, Jennings's being best. There is a more recent patent—Whitehouse's 'Unbreakable,' which is good. If the expense were not so great, and if the work done is always in *new* wood, a full set of these excellent bits might well supersede all others for general requirements. It is scarcely needful to say anything about reamers or taper shell-bits, etc., or countersinks, but if desired, I will do so with pleasure."

**Fret Machine.**—J. H. W. (*Chatham*) writes, in answer to E. J. H. (*Stoke Newington*) (see No. 99, Vol. II., page 764):—"Thinking that you are seeking a fret machine cheap, strong, and serviceable, one which will be quite as good as a first-class machine as regards work, if you make it the same as the sketch enclosed. I know it will give you every satisfaction. I have made one, as I said before, so know what it will do. My friends about me are making machines like the one I have; they are delighted with it, for it costs but a trifle—2s. 6d. will clear everything. I will describe the machine as under:—F is the arm above the table, secured so as to work easy in the slotted upright A with a bolt; A is a piece of wood slotted as in sketch, so as to

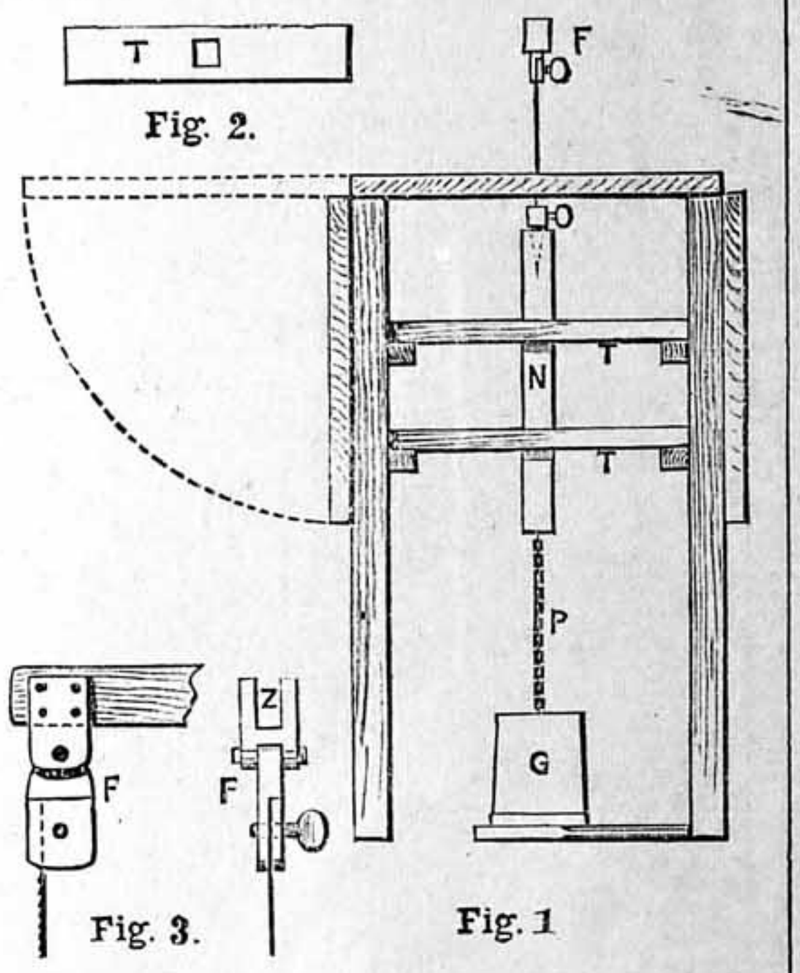



Fig. 2. Fig. 3. Fig. 1

Fret Machine Parts.

allow the arm to work inside the slot, and secured to your table with screws to treadle; E, stay for securing the legs of machine; B, strip of wood, say, about 1¼ in. by ¾ in., screwed to table as in sketch; C are pieces of thin indiarubber, wound round the arm and your strip of wood at B. That gives you the spring, and a very good one—a small bicycle tire is very good for it; H is a stop or guard to

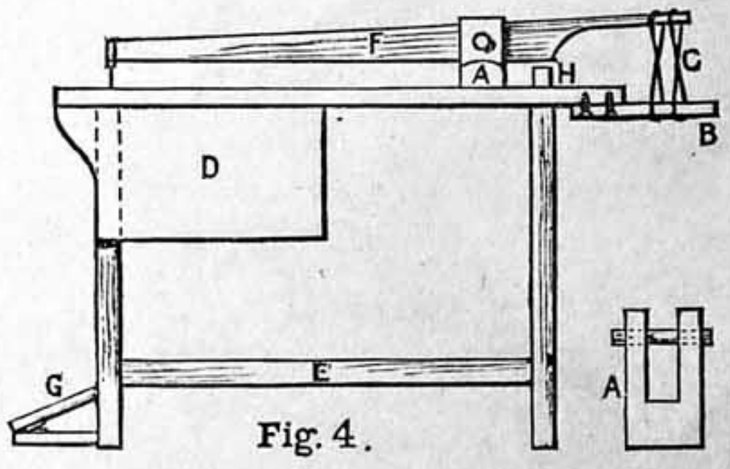



Fig. 4.

Fret Machine. Front and Side Views and Parts.

prevent your arm rising too high; F is the cramp for holding the saw, secured to the arm with screws—it is a knuckle-joint, easily made; N, a piece of 1 in. square wood with your bottom cramp driven into it; T are two stays through which N passes, and keeps it in position; D are leaves to the table by which you can increase the size, according to class of work; P, chain secured to N down to G. This machine can be made of wood, except the cramps for holding saws, and, I think, within the reach of every working man to make. I shall be only too pleased to give anyone more information about it if they will write."

### V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. W. M. (*Stepney Green*); ACCRINGTON; A. L. W. (*Wales*); VULCAN No. 1; ROMEO; E. H. H. (*Chatham*); VULCAN No. 2; W. D. (*Ireland*); R. J. (*South Devon*); LOOKER-ON; V. W. (*Southsea*); W. B. (*Dresden*); G. H. C. (*Stroud*); T. B. (*Harwich*); READER; J. B. (*London, W.C.*); J. E. W. (*Camberwell*); H. R. P. (*Lambeth*); SPRING; W. R. K. (*North Shields*); F. F. (*London, W.*); J. S (*Edinburgh*); EAST RIDING; SIGMA; D. A. F. (*Northamptonshire*; JAMES; R. W. S. (*Leeds*); A. A. (*Inverness*); KILDONAN; A BEGINNER; YOUNG HAND; W. B. & Co. (*West Kensington*); W. K. (*Heptonstall*); MART; R. M. (*Braintree*); A. K. (*London, S.E.*); C. E. T. (*Birmingham*); W. H. (*Stirling*); J. B. (*Ilkley*); AXLE; J. G (*Nottingham*); FOURDRINIER; FAITHFUL READER; E. A. P. (*Beckenham*); WHEELER; B. H (*Birkenhead*); MASON; R. H. (*Bradford*); JASPER; J. H. P. (*Liverpool*); F. H. (*Highbury*); H. B. (*Hammersmith*); C. E. B. (*Poplar*); A. W. (*Hackney, E.*); F. L. B. (*Barham*); W. T. (*Penge*); H. H. L. (*Liverpool*); J. S. (*Longsight*); F. H. (*Streatham Hill*); W. E. W. (*Wimbledon*); C. B. (*Tonbridge*); L. E. (*London, E.C.*); W. H. (*St. Helens*); AMATEUR; A. N. G. (*Bristol*); J. H. D. (*Halifax*); A. H. (*Cape Town*); LATHE; R. P. (*Camden Town*); TENNIS; E. G. (*Urdington*); T. J. (*Cheadle*); F. M. G. (*Edinburgh*); VICTOR; E. G. P. (*Kingston*).

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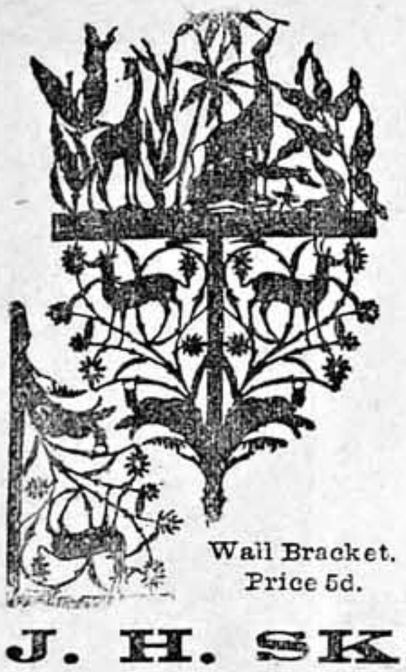

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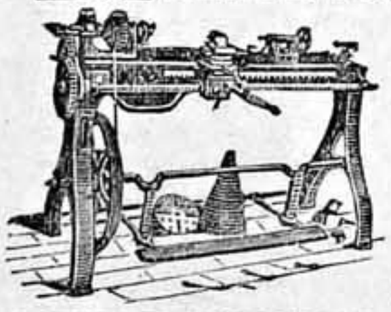

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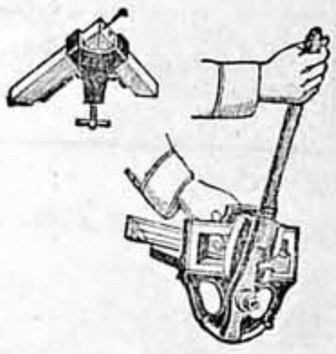

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